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# FRONTISPIECE.

PENNY MECHANIC.

Permit me to
introduce to
your notice the
PENNY
MECHANIC.

THE

# PENNY MECHANIC;

## A MAGAZINE

OF THE

## ARTS AND SCIENCES.

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VOL. I.—1837.

**ILLUSTRATED BY MR. G. H. WALL.**

BIRKBECK COLLEGE

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# PREFACE.

The Editor of the "Penny Mechanic" gladly avails himself of the opportunity afforded by the publication of the first Volume, to thank his readers for the kind and active support he has received from them, and also to congratulate them on the success that has attended both his and their exertions. The want of such a work had long been felt by a large class of operatives, and its success may principally be attributed to the fact, that it has, to a certain extent, at least, been the means of supplying this want. It has been the anxious endeavour of the Editor to bring before his readers only such matter as he thought might prove of practical utility to them; abstruse subjects, that would only prove interesting to a few, have invariably given place to articles which it was thought would prove entertaining and instructive to the many. In taking a summary view of the contents of the Magazine, the Editor refers with pleasure to the many ingenious inventions that have been described. The Arts and Manufactures have not been neglected. Descriptions of many ingenious processes, which it required a work of this kind to make known, have been brought before the reader in a popular manner; and in the succeeding volume of the work, the Editor will endeavour to give descriptions of the more important processes in the arts now carried on in this country. The Student in the Sciences will find many papers in this Magazine worthy his attention. Many ingenious pieces of apparatus have been noticed, and also the mode of constructing various kinds for illustrating facts in experimental philosophy in an economical manner. The best method of conducting various experiments in the Sciences, have likewise been published. The articles on the Phenomena of Nature, and the Biographical Notices of some few eminent men, will not, it is hoped, be without their utility. In endeavouring to advance the social and intellectual improvement of his readers, the Editor has not failed to direct their attention to what he considered inimical to such improvement, as well as to the means by which it might be promoted. The Notices of Lectures at the various Mechanics' Institutions each week, have, he is aware, been the means of inducing very many readers to avail themselves of this means of improving their mental powers. Acting, also, on the principle, true to a certain extent, that one

square inch of wood is worth a page of letter-press, every Number has been well illustrated, by which means many complicated pieces of machinery have been explained, that could not have been described without the assistance of the draughtsman.

The Editor has done all he could to make the work useful to his readers; but of course, at the commencement of every publication, and one like this in particular, many difficulties have to be contended with, which are only to be overcome by time and experience. In conducting the next Volume, these difficulties will no longer impede the Editor, and he will be able to introduce several improvements that have hitherto been impracticable. He depends on the kindness of his readers and correspondents for a continuance of those exertions, to which the success of the Magazine is mainly to be attributed. It is now a publication devoted to the improvement of the working man. His inventions, that otherwise might remain unknown for want of patronage, shall ever receive the best attention of the Editor, and be communicated to the public in a manner calculated to obtain encouragement and support. His queries respecting any process with which it may be necessary that he should become acquainted, and which other working men (readers of the Magazine), may be able and willing to give him information upon, shall always be readily inserted. In short, every thing shall be done that can be done, to render the work useful to him, and it is hoped, in return, that he will endeavour to promote the success of *his own Magazine* as much as possible.

The Editor has to offer his acknowledgments to his numerous correspondents, for their many useful communications, and he trusts that the next Volume will not be less indebted to them for its interest than the present.

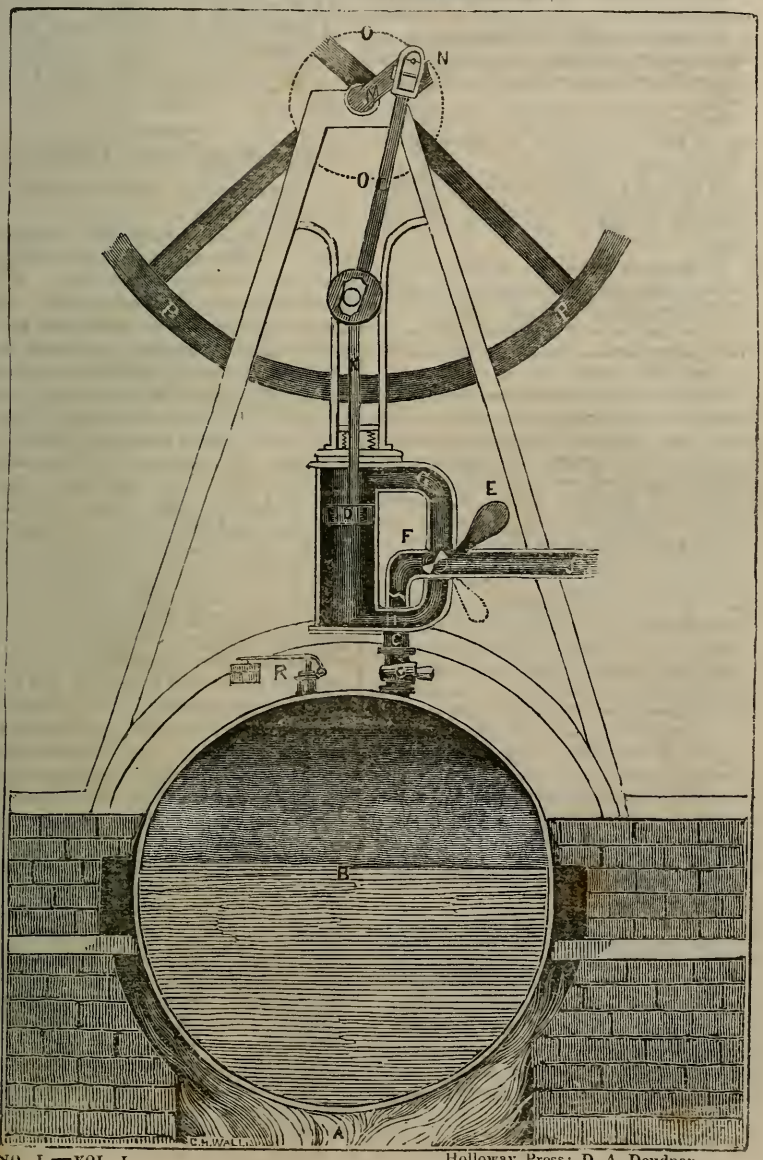
# THE PENNY MECHANIC;

OR, MAGAZINE OF ARTS AND SCIENCES.

No. I.]. SATURDAY, NOV. 5, 1836. [Vol. I.

Notice.—We announced in our Prospectus that we should give an Engraving of the Opening of the Greenwich Railway in the present Number; but, in consequence of the Ceremony having been postponed, we are prevented doing so: when it takes place we will fulfil our promise.

THE HIGH-PRESSURE STEAM-ENGINE.






Holloway Press: D. A. Doudney.

## TO OUR READERS.

On presenting ourselves for the first time before the Public, it is proper, perhaps, that we should briefly state the objects the Magazine will endeavour to accomplish, and thus inform our readers of the general principles on which it will be conducted.

The objects, then, "The Mechanic" has in view are—

To assist in the diffusion of Scientific knowledge amongst the people, and also to improve their social and moral condition by all available means.

To show the application of scientific knowledge to the various occupations of Mechanics and Working Men.

To notice all Inventions and Discoveries likely to prove useful to Artizans, and to collect information that will assist them in their employments.

To report the proceedings of Mechanics' Institutions, and other Educational Associations, for the Improvement of the People. And

To point out to our Readers such works as we think calculated to assist in forwarding the objects we have in view.

For the purpose of carrying the above objects into effect, a portion of the work will be devoted every week to illustrate some branch of Natural Philosophy. Essays on subjects connected with the social and moral condition of Society will also be given, with Reports of interesting Lectures—and miscellaneous information connected with the progress of Science and Art.

We do not think it advisable, however, to confine ourselves to any particular plan. Our earnest endeavour will be to make the Magazine useful and interesting. Without it has the latter quality, we feel assured that its utility will be comparatively trifling; and abstruse subjects will therefore seldom find admission to our pages. It is the general reader we wish to interest; and this we shall endeavour to do as far as lies in our power. Dr. Arnott has observed, "It is not necessary, in order that a person may understand the principles of Natural Philosophy, that he should be a mathematician. The mathematics of common sense will enable him to comprehend all the great laws of nature;" and we hope to demonstrate the truth of this assertion as the Magazine proceeds.

It has been truly remarked, that Science is of no country, or party; and the same observation will apply to all subjects that have the happiness of mankind for their object. We shall therefore most carefully abstain from making this Magazine a vehicle for party purposes. Its pages will always be open to the man who wishes to make his knowledge useful to others; but we will have nothing whatever to do with party differences.

As this Address is written for the purpose of informing the Reader of the kind of matter he may expect to find in "The Mechanic," and not to claim his support merely on account of our being actuated by an earnest desire to improve the Education of the People, or by any other motive, we think we have stated all that is necessary. "The Mechanic" must advocate its own cause. If such a work is wanted, and if it is conducted in a proper manner, we have no doubt it will meet with adequate support; and with the conviction that this will be the case, we send it forth to the world, earnestly hoping that it may accomplish all the good we anticipate.

## EXPLANATION OF THE ENGRAVING.

A, the fire-place, where heat is formed by combustion of the coals or other fuel.

B, the boiler, about half filled with water. In the upper part of this boiler, above the surface of the water, is the space occupied by the steam. The heat below has been transmitted to the water. The water has boiled, and in its ebullition keeps generating more steam. If the fire be kept brisk, and no passage provided for the steam to escape from, it is clear the steam must be confined or pent up, and more ready to rush out at the first vent. More and more heat is applied below. The water absorbs it, and more and more steam is generated, which steam, from every thing being closed, is very much pent up, and is in the state called high-pressure. Of course, if we still keep adding heat, and generating steam, the pressure within will be too great for the strength of the boiler to stand, and the boiler will burst. Some steam-engines are intended for work with one pressure, and some with another. There are steam-engines which work with 30 lb. pressure upon each square inch of the boiler, and those which work with 200 lb. pressure upon each square inch.

At first it would appear that the high-pressure engine is more dangerous than the low-pressure engine. But such is not found to be the case in practice. In all cases where high-pressure boilers have been attended with danger, there has been the most gross and culpable neglect: under which the same thing would have, and has happened, with low-pressure engines; and in almost every case of sudden explosion the boilers have been made of cast-iron instead of wrought iron: and it may have the

effect of removing all fear when we say that some recently-invented boilers, such as Gurney's or Hancock's, are completely free from danger.

When the steam is raised in the boiler B, and ready for use, we open the cock C, and the steam will flow up the pipe C, and past G, and press the piston D in such a manner, that D will descend, pushing before it the air or vapour which is below it, and in the pipes leading from the lower part of the cylinder. This air or vapour will be driven along the pipes, and through H F out into the atmosphere J, where it will be dissipated. It will now be seen that the piston D has traversed from the top to the bottom of the cylinder. Now if the handle E (the handle of a cock, F) be turned into the dotted position, it is clear the cock it acts upon will have a similar movement, and open the communication from G to the atmosphere J; whilst the communication C F H will be opened from the boiler, to allow the steam to act on the under side of the piston D to press it up again. —Thus the piston will alternately be raised and depressed; and so long as the boiler supplies steam, this alternating motion will be continued: the cock (valve) F being turned at each movement, so as to allow the steam to press on the one side of the piston, whilst it allows the steam at the other side to rush off into the atmosphere at J.

But the turning of the cock (or valve) is not a manual operation. The hand is only applied to it when starting or stopping the engine. When the engine is at work, she opens and shuts for herself; a simple piece of mechanism, appropriately called a tappit, striking the handle E on the one side or the other as required. We have not shown this, lest the drawing should be too complicated. Suffice it to say, the engine can be made to do it.

When the piston D is driven from one end to the other like a shuttle-cock, it will be obvious that the piston-rod K is driven with it. This rod is connected by another rod L, which acting upon the crank M, turns it round, describing the dotted circle in the direction of the arrow. Thus, from the alternating rectilinear motion of the piston, a continuous circular motion is obtained. But it will be seen that when the part marked N reaches in its revolution either of the points O, there will be an uncertainty which way it would turn to go the next circle: it might falter and go back again. In stationary engines a heavy fly-wheel P helps the motion to continue over these centres, as they are called. In steam-carriages, however, the weight of a fly-wheel is so great that it cannot be used, and therefore two engines are used to the same boiler; one engine always being in full force when the other is passing the centre—so that there is a continuous and unimpeded motion round the circle.

The power of the engine is calculated by the effect it produces in moving the piston at a given speed, from end to end of the cylinder. Suppose the steam presses on the side of D next the boiler with a force equal (say) to 50 lb. on each square inch, and the force of the atmosphere, 15 lb. on each square inch, is all that opposes the movement of the piston; the difference betwixt the 50 lb. pressure of steam and the 15 lb. pressure of the atmosphere, is 35 lb.; and if the area of the whole piston D be 28 square inches, we have a positive pressure of 980 lb. to move the piston D up to the other end. When it arrives at the upper end the cock F is turned, so as to allow the steam to enter at the other (that is, the upper) side of the piston D, to drive it back again. We have already shown how the steam below the piston is got rid of; it (at 980 lb. pressure) rushes off into the atmosphere.

The *steam* blown away requires to be repaid to the boiler in *water*, which is done by a little pump worked by the engine.

R is a safety-valve which is of a certain weight, or having weights on it. Say in the present instance that the area of the valve is one square inch; then the weight on it must be 50 lb. It will easily be seen, that if by neglect or any other cause, too much steam, or too great a pressure of steam should accumulate in the boiler, this valve will rise, the steam will blow away, nor will it shut again so long as the steam is at a pressure above 50 lb. the square inch, which it is, in this instance, intended to work to. The valve may be so adjusted as to blow open at a single pound pressure, at 300 lb. pressure, at any intervening pressure, or any higher pressure.

## Natural Phenomenon.

### CAUSE OF RAIN.

How many persons there are who have frequent opportunities of witnessing some of the most beautiful phenomenon of nature, and yet are incapable of deriving the slightest mental gratification from the contemplation of them! How many lose some of the highest gratifications man is capable of receiving, for want of knowing how to enjoy them. This is to be regretted, because the man who can

Find tongues in trees—books in the running brooks,
Sermons in stones, and good in every thing,

will be a far happier, and in every respect a far better man, than he who has no such sources of enjoyment. If we look around us, however, we shall find by far the greater number of persons do not understand, and are consequently incapable of enjoying, the pleasure to be derived from observing the harmonious manner in which the lews of nature operate. Ask such persons the cause of the wind blowing, or why the tide ebbs and flows, and how many will be able to answer the question? It appears strange that persons who are constantly witnessing these things should not desire to know the cause of them, but we should remember that, however interesting an object may be when we view it for the first time, yet, if it frequently occurs, we cease to regard it with attention, and at last become quite indifferent about it. To this circumstance we must attribute the general ignorance that exists, even amongst persons of good education, respecting the cause of most of the phenomenon of nature. They are so frequently witnessed, that they are thought very little about. Few persons, however, we think would wish to remain ignorant, whan they may easily be instructed, and a few observations, occasionally, upon the subject will therefore, perhaps, prove interesting.

There is one topic of conversation in this country which appears never to lose its interest. Every body can say something upon it, and it generally takes precedence of every thing else—we mean, of course, the weather. In a country like this, where it is subject to such sudden changes, it is rather surprising so many vague and incorrect opinions should exist respecting it. One person considers the influence of the moon the grand power which regulates the state of the weather; another is equally confident, that all its changes are occasioned by the wind, and so on. Yet very few can really tell why so apparently-simple a phenomena as rain occurs. The fact is, "doctors differ" considerably on this subject, and numberless theories have been propounded to explain it. The most probable we think has been proposed by Dr. Hutton, which may be explained in the following manner:—

If we leave a little water, in an open vessel, exposed to the atmosphere for a few days, we shall find, at the end of that period, that the water has dried up, or, in other words, has evaporated. To explain the cause of this, many reasons have been assigned; but it is unnecessary to enter upon a consideration of them at present. It is sufficient to state that the atmosphere has the power of absorbing, and holding in solution, great quantities of water. It has been calculated that assuming the surface of all the water on the earth to be equal to 130,000,000 geographical miles, that about 60,000 cubic miles of water will be changed into vapour every year. Now, the whole of the water is precipitated to the earth again in the form of rain, and the cause of this, according to Dr. Hutton, will, perhaps, be understood by describing a simple experiment, which every one can perform himself.

Take two beer tumblers, and into one put a little water, just enough to wet the sides, then hold the gass near the fire, till the air in it having become heated has absorbed the water. If the edges of the other tumbler, which has been kept cool, be placed upon the one that has been warmed, the sides of the latter will become covered with moisture. Dr. Hutton explains this as follows:—"According," says he, "to the temperature of the atmosphere so is its power of containing fluids in a state of vapour. A warm atmosphere will absorb a greater quantity of water than a cool atmosphere; and if, therefore, a current of warm air mixes with a current of cold air, a part of the vapour

held in solution by the former will be precipitated to the earth in the form of rain; because the temperature of the warm air will be reduced by its mixture with the cold, and its capacity or power of containing vapour be thereby diminished. When, therefore, in the experiment above described, we place the tumbler containing cold air upon that containing warm air, holding water in solution, the temperature of the air is reduced, its power of holding so much water in solution is diminished, and hence the water is precipitated, and forms a moisture on the sides of the glass."

Some philosophers have imagined that rain is the result of an electrical action of the clouds upon each other; and there is very probably some truth in this theory, because we know how suddenly, and with what violence, rain is generally precipitated during a thunder storm. But there can be no doubt but that it is principally to the changes in the temperature of the atmosphere we must attribute the cause of rain.

## THE STEAM ENGINE.

Amongst the numerous and irresistible proofs that improvement is an attribute of human nature, the steam-engine may claim to be considered as one of the most important. The change that has been effected in the manners and social condition of every nation on the face of the earth, by its agency alone, is so astounding, that its history appears to be rather the realization of a tale from the Arabian Night's romances, than an event that has really occurred.

In considering its importance, merely in this country, we must not ask ourselves the question, "What does it do for us?" but rather, "What does it not do for us?" Our meanest enjoyments result from its influence. Our very existence at the present time, may be said to depend upon it. From our cradles to our graves we are hourly indebted to it. Our swaddling clothes are made of fabrics it has manufactured; and the corn from which our bread is prepared, has been converted into flour by it. Nor are our intellectual wants less dependent upon this mighty power for their gratification. What is not done for us by the printing machine? The people's schoolmaster! What stores of knowledge have been thrown open to the vast multitude by this offspring of the steam-engine! The very paper on which these words are printed, could never have been placed in the reader's hands, even for a dozen times the amount it costs him, were it not for the steam-engine. But, besides all this, it transports us from place to place with a rapidity that would appear miraculous to our forefathers, could they rise from their graves and see the steam-boat traversing the ocean, regardless alike of wind and tide; or the railway engine drawing after it, with more than giant's strength, long trains of carriages laden with merchandize and passengers. In a word, to the steam-engine we are indebted for nearly every comfort we enjoy. It provides us food—it manufactures our clothes—it even procures the means of warming our habitations—it brings us drugs from foreign countries to relieve us when we are suffering from illness—and it affords us the means of travelling with the greatest ease and pleasure during health—lastly, after "life's fitful fever," it is employed in preparing our very coffins, and will perhaps shortly be the means of conveying us also to our graves!

A description of the wonderful machine that is capable of performing all this, cannot fail of proving interesting to our readers; and we intend, therefore, in our future numbers to give a succinct, yet we hope intelligible history of the steam-engine, and of the various improvements which have been made in it, from the time that it was first made available for useful purposes to the present. We intend amply to illustrate the subject with engravings, and have no doubt it will be found highly interesting, as well as instructive.

Before entering, however, upon this subject, it is necessary that the reader should be made somewhat acquainted with the nature and properties of steam; and the present paper will therefore be confined to this subject, and the history of the steam-engine will be commenced in our next.

One of the properties of heat is its

power of expanding all bodies into which it enters. Thus, a piece of iron made red hot, will be found, on examination, to have increased in bulk; and the same effect takes place in all other bodies, with one or two exceptions, for which no explanation can be given. Now, when water is exposed to the action of heat, it also expands, and assumes a gaseous state, called steam. In this condition it is very elastic, and, like the atmosphere, invisible. The "steam" that is driven out of the spout of a kettle of boiling water is visible enough, it may be said! But this vapour is not steam, properly so called. It is steam condensed into an aqueous vapour by the atmosphere, for steam itself is perfectly invisible.

Water is converted into vapour at nearly all degrees of temperature, but its elasticity at a low temperature is weak, and increases according to the increase of heat. At 212° the elastic power of steam is equal to that of the atmosphere; and at 419° is 1050 times greater; it then exerts a pressure of nearly 15,000 lbs. on every square inch of the inside of the vessel in which it may be confined. It has been found by repeated experience that steam, at the temperature of 212°, occupies about 1800 times the space of the water from which it is formed. But till the commencement of the present century this fact was not generally known. It was thought that the expansion was 14,000 times the volume of water which produced it; this has, however, since been proved erroneous.

Now, if the reader has understood what has just been stated, he will at once perceive that very great power is generated in the formation of steam, and it is in order to regulate and direct this power to useful purposes, that all the complicated, yet beautiful machinery of the steam-engine is employed. We must not omit to mention, while on this part of the subject, that steam can be suddenly condensed, however great may be its state of expansion, into the same quantity of water that it formed before the application of heat had changed its condition; and it was for the purpose of making available the force generated in this manner, that many of the first-invented steam-engines were constructed. It is the expansive force of steam, however, that is the prime mover of the engines of the present day; and thus, to the apparently trifling circumstance, of water being converted into an elastic vapour, by the agency of heat, we owe the existence of a power which can "engrave a seal, and crush a mass of obdurate metal like wax before it; draw out, without breaking, a thread as fine as gossamer, and lift a ship-of-war like a bauble in the air; or embroider muslin, forge anchors, cut steel into ribands, and impel itself against the opposition of the very tempest."

## THE AURORA BOREALIS.

On Tuesday evening, the 18th ulto., the inhabitants of the Metropolis had an opportunity of witnessing this beautiful phenomena, which is so seldom to be seen in this country. About eight o'clock "the greatest excitement and anxiety," according to the newspapers, prevailed, in consequence of the sky becoming of a dull red colour, and presenting a similar appearance to what it does during an extensive conflagration. It was accordingly supposed that a very dreadful fire had broken out somewhere very near London, and accordingly the engines of the different establishments were immediately got ready to proceed to any part of the town where the fire might be found to have occurred. A correspondent in the "Times" states, that Mr. Broadwood, the superintendent of the engine establishment in Watling-street, accompanied by eight of his men, proceeded with an engine towards the spot where the destructive element appeared to be raging. On arriving at Clerkenwell Green, where the fire was at first reported to exist, he was joined by the engines from the Whitecross-street, Farringdon-street, and Holborn stations, which were proceeding towards Clerkenwell Prison, that building having been stated to be in flames. From that spot the scene of the supposed devastation appearing to be more distantly situate than was at first anticipated, and various localities, such as Islington, Holloway, Highgate, Hornsey, the New Cattle Market, Ball's

Pond, &c., having been assigned it, Mr. Broadwood determined on sending engines in each of these directions, whilst he returned to Watling-street to await authentic intelligence of the precise spot. The engines from the Crown-street, and other more western stations, had, in the mean while, proceeded towards Camden-town, Hampstead, and Finchley, the supposed fire appearing from that part of the town to be in one of those directions; but after scouring the country for miles round, the whole of the engines returned to their respective stations, it having been discovered that the appearance of the sky had been caused by the aurora borealis. It is somewhat singular that in various parts of France similar confusion was created, from its being generally supposed that a great fire had broken out in the different towns where the aurora was visible. It was not seen in Paris, but appeared with great brilliancy at Nantes, Strasburg, and several smaller towns. About November, last year, the aurora was seen in London, but it did not then present so fine an appearance.

*(To be continued.)*

## Mechanics' Library.

Under this head it is our intention, occasionally, to give a short analysis of good works on natural philosophy, and indeed on any subject with which we think our readers should become acquainted. These reviews will not be confined to books recently published, but those which have been before the public some time, if they are deserving of notice, will also have a place in our "Library." Thus, after a little time, a person desirous of knowing which are the best works to consult on any subject—particularly those connected with science and art, will be able to do so by merely referring to The Mechanic; and another advantage will be, that persons having but little money to expend in the purchase of books, will know how to lay it out to the best advantage.

*Arnott's Elements of Physics.*

We think this is the best book on natural philosophy that has ever been published. The most profound truths are explained in a manner so perspicuous, that we think every one who can read and possesses common sense, can understand them. There is no pedantic display of learning, no unnecessary "hard names," in this excellent work. But all the grand laws of nature are explained by simple and familiar illustrations, which no one can misunderstand. How different this to most works on philosophy! The manner in which Dr. Arnott has arranged his subject is peculiarly calculated to impress it on the mind. Each chapter is prefaced with a synopsis of what it contains, and the principle it is intended to illustrate is also clearly stated. Then each chapter is divided into parts, devoted to the explanation of some fact connected with, or dependent on the law stated in the synopsis; and any important word, as "atom," "inertia," "friction," &c., is illustrated by numerous examples, most of them familiar to us in our every-day occupations.

The first volume of the Elements of Physics embraces mechanics, pneumatics, hydraulics, acoustics, and the general properties of matter; the second volume treats of the imponderables—light, heat, electricity, magnetism, and the elements of astronomy. Thus a person possessing these volumes has the means of acquiring more correct knowledge than was known to the most eminent philosophers of old.

We much regret that the cost of Dr. Arnott's book prevents those for whom it is so well adapted—the working classes—from obtaining it. The wood-cuts are so numerous that we know the expense of printing it must have been very great; but the number of readers has so much increased, even since the publication of the first edition, that we feel confident, if the book was brought out at half its present price, it would meet with more than double the number of purchasers of former editions. Even if it was brought out in weekly or monthly numbers, at its present price, it would be certain amply to repay the cost of publication.

*Painting on Glass.*—A foreigner is said to have discovered, in an old manuscript, the method by which the ancients were enabled to practise this art. It has been so long lost sight of, that its discovery is an event of some importance.

## Institutions.

A most entertaining and instructive lecture on the History of the Assyrian and Babylonian Monarchy, was delivered at Mr. Lemon's, Palmer House Academy, Islington, by Mr. Chalklen, on Tuesday last. We are sorry our limits will not allow us to enter into a detail of the merits of the speaker in our present Number; we content ourselves therefore by referring to the announcement below.

The Music Class of the London Mechanics' Institution, gave a concert on Tuesday evening last, which was well attended, and passed off with great eclât. The performance was highly creditable to the class.

A meeting was held on Monday evening, at the Southampton Coffee-house, Chancery-lane, for the purpose of forming an association to support Mutual Instruction Societies, &c., with the loan of apparatus and diagrams; to illustrate lectures; and to provide them lecturers when required. Rules were adopted, and a Committee appointed. Mr. Lewis, of 17, Edward-street, Hampstead-road, is the Secretary.---*From a Correspondent.*

LECTURES DURING THE WEEK.

*Western Literary and Scientific Institution*, 47, Leicester-square.—THURSDAY, Nov. 10, at half-past Eight, LECTURE by Mr. Cowper on Engraving and Paper Making.

*London Mechanics' Institution*, Southampton Buildings, Holborn.—FRIDAY, Nov. 4, at half-past Eight, Rev. W. J. Fox, LECTURE on the Study of the Philosophy of the Human Mind. —WEDNESDAY, Nov. 9, Dr. Ritchie, LECTURE on Optics.

*Lambeth Literary and Scientific Institution*, Waterloo Bridge-road.—TUESDAY, Nov. 8, at half-past Eight, Dr. Ritchie, LECTURE on Machinery.

*Islington Literary and Scientific Society.*—Thursday, Nov. 10. at Eight o'clock, Mr. Sheridan Knowles, LECTURE on the Drama.

*Eastern Literary and Scientific Institution*, 88, Hackney-road.—TUESDAY, Nov. 8, at half-past Eight, T. R. Jones, Esq. on the Structure and Habits of Insects.

*London Institution*, Finsbury Circus.—Monday, Nov. 7, at Seven o'clock, W. T. Brande, Esq., on Chemistry.

*Palmer House Academy, Holloway Road.*—TUESDAY, Nov. 8, at Seven o'clock, Mr. Chalklen, LECTURE on the Sublime in Objects and in Writing.

## Miscellanies.

*To Revive Old Writing.*—Boil gall nuts in wine, then, with a sponge dipped in the liquid, wipe over the lines of the old writing, and all the letters will again appear distinctly visible. This should not be attempted with documents that are required to be preserved, as it has a tendency to destroy the material. But when it is required to decipher any old writing, in order to copy it, the above receipt will be found useful.

*Power of the Windmill.*—A windmill with four sails, measuring seventy feet from the extremity of one sail to that of the opposite one, each being six feet and a half in width, is capable of raising 926 pounds 232 feet in a minute; and of working, on an average, eight hours a day. This is equivalent to the work of thirty-four men; twenty-five square feet of canvas performing the average work of a day labourer. A mill of this magnitude seldom requires the attention of more than two men; and it will thus be seen that, making allowance for its irregularity, wind possesses a decided superiority over every species of animal labour.

*To Prevent Burning the Fingers.*—Now that Christmas will so soon be here, we dare say most of our young friends will be glad to learn how they may play at "snap dragon" without any fear of burning their fingers. If cherry-tree gum and alum be pounded together, in equal quantities, and the powder mixed with some strong vinegar, which must then be left in a vessel, over hot ashes, for about four-and-twenty hours, any thing rubbed with this composition, after it has become cold, will not burn.

*Greatest Heat of Water.*—Water, when exposed in an uncovered vessel to the action of heat, can never be raised to a higher temperature than 212°, the boiling point; because, when this degree of heat is attained, steam begins to be given off, and all the additional heat to which the water is exposed, will therefore be engaged in producing steam, and not in increasing the heat of the water.

*Horses* v. *Men.*—When private carriages first became common in this country, an act of Parliament was passed to prevent the too great adoption of these vehicles, *lest the horses should consume the food of the poor.*

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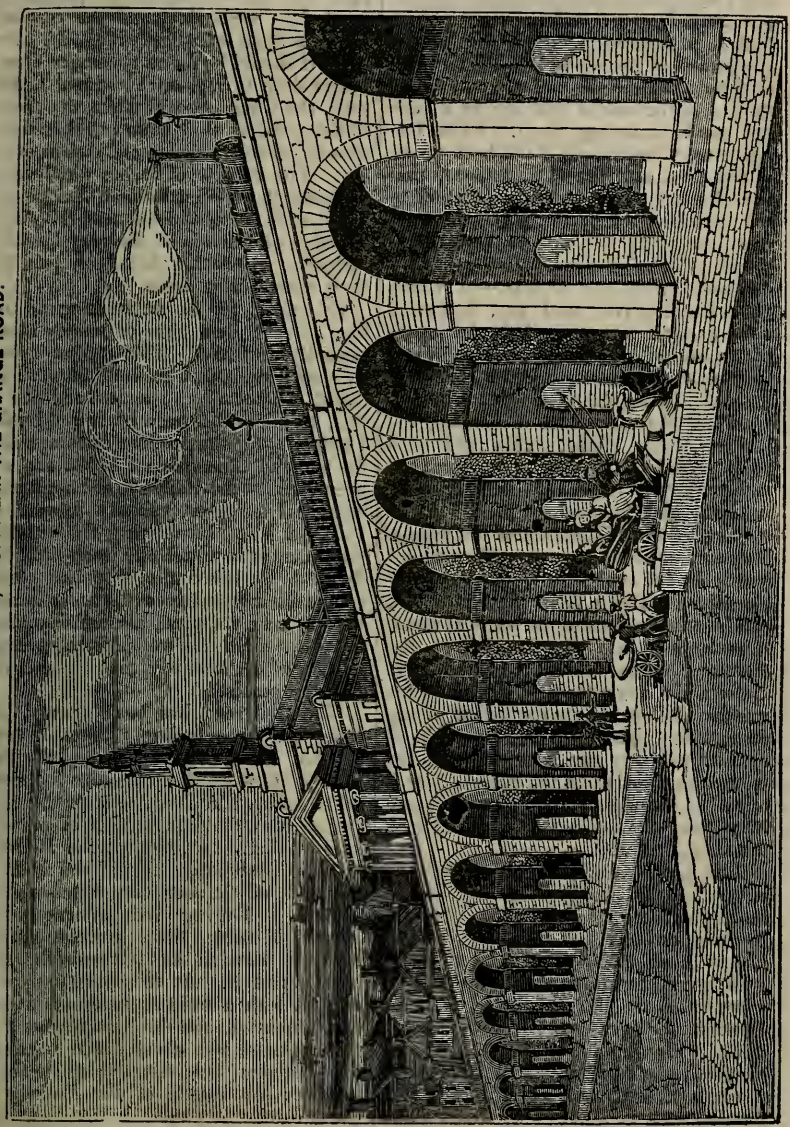
# THE PENNY MECHANIC.

A MAGAZINE OF ARTS AND SCIENCES.

No. II.] SATURDAY, NOV. 12, 1836. [Vol. I.



THE GREENWICH RAILWAY, FROM NEAR THE GRANGE ROAD.



Holloway Press: D. A. Doudney.

## THE GREENWICH RAILWAY.

Of all the applications of the steam engine to purposes of utility, the most important, perhaps, is its employment on rail-roads. The civilization of every country depends so much upon the facility with which the inhabitants of one part can correspond with those of another, that it is invariably found, that where the means of travelling are difficult and uncertain, the people are not only ignorant, but the useful arts are in a very low condition among them. Every enlightened Government have been aware of this fact, and the circumstance, that the Romans paid so much attention to the formation of good roads, is a proof how important the subject was considered, even in the semi-barbarous age—compared with the present—in which they lived. We need not, however, refer to such remote periods, for proofs of the absolute necessity for certain and easy modes of conveyance, in order to promote the welfare of a country. Many Continental nations offer melancholy instances of the truth of this, and until their means of internal communication is very much improved, there can be but little hope entertained of the political and social amelioration of the people. The commerce of a country likewise depends on the ease with which the merchandize, brought from foreign parts, can be conveyed from the ports at which it is landed, into the interior of the country, where it will be consumed. Indeed, the advantages which must inevitably follow, where the means of accomplishing this object exist, must be so evident to every one who will take the trouble to think upon the subject, that it is rather surprising rail-roads have not been generally adopted in England long ere this.

The London and Greenwich Railway is the first that has been opened, having its commencement in London; and the remarks we have just made on the importance of railways generally, apply with particular force to this one. It commences on the Southwark side of London Bridge, and proceeds in a straight line, till it arrives at Deptford, to which place it is only finished. Here it sends off a branch, which runs nearly parallel with Deptford Pier; and when completed, the Railway will make a slight bend to the left from this part of the line, and then go on direct to its termination, near Thornton-row, in Greenwich. The Railway is built on arches, formed of brickwork, about 22 feet high, and has two lines of rails for the carriages. A parapet is erected on each side, and the roadway between them is 22 feet wide. If, however, it should be found necessary at any future time to add an additional line of rails, the Company will have the power of doing so, as they have purchased the ground on each side, to the extent of 25 feet. The number of arches which form the viaduct, between London Bridge and Greenwich, is about 1000, and the workmanship of them is of the very best description. 100,000*l.* has been paid for their construction alone.

Of course, for an undertaking of this kind, a very great sum of money is necessarily required. The capital raised by shares amounted to 400,000*l.*, which has all been paid up; and in addition to this, 133,000*l.* has been borrowed by the Company, for the purpose of completing the works. The ground which has not been used for the Railway, although purchased, is, however, valued at upwards of 112,000*l.*; and considering the satisfactory manner in which the work has been finished, we think the proprietors may congratulate themselves that more money has not been required, particularly when it is considered how valuable the greater portion of the land is through which the Railway passes.

The Rail-road has been opened for some time, from a short distance beyond London Bridge to Deptford; the line having been completed thus far for several months. The fare has been sixpence each person, and the number of passengers who have travelled on the Railway is quite surprising. From the 10th to the 26th of October they amounted to 31,707. During the afternoon of Easter Monday, 6312 persons passed between London and Greenwich, and back, upon it. At that time only one engine, with a train of seven carriages, was employed, and the time occupied in each passage was about seven minutes. The distance, was only two miles and a quarter: the length of the Railway is about three miles and a half. It is calculated that the passage, to and from

Greenwich, will occupy about ten minutes. The Company are prohibited from taking higher fares than are directed by their Act of Parliament; and the following are the charges determined on, now the Railway is finished:—

| | | |
|---|---|---|
| By the first class carriages | 1s. | 0d. |
| ——— second ditto | 0s. | 9d. |
| ——— third ditto | 0s. | 6d. |

Persons who reside at Greenwich, or who have frequent occasion to travel on the line, will be allowed to do so on paying a certain sum quarterly. Some individuals have found fault with the Company for not having one fare only, and that sixpence. But the directors will be the best judges of the policy of continuing their present fares; and no doubt, if they find the charge can be reduced, they will do so. At any rate it will be a great saving to persons living at Greenwich, who have occasion to come to town every morning; for besides gaining a great deal of time—about 45 minutes each journey, or nearly 600 hours in the course of a year—an individual who travels by the first-class carriages of the Company, instead of going inside the stage coach, will save upwards of 30*l.* per annum.

It is intended that a train shall leave London for Greenwich every quarter of an hour, and return at the same intervals. Each carriage will hold thirty persons; and from twelve to fourteen carriages can be attached to one engine. On extraordinary occasions, such as Easter or Whitsun Monday, the engine will leave every ten or five minutes, or oftener if necessary. The whole line will be lighted with gas, and the travelling will therefore be as easy by night as by day.

Of the great advantages of this Railway, we have not occasion to say much, they must be so very evident. If the sanction of Parliament can be obtained to an act for carrying it on to Gravesend, Chatham, Canterbury, and Dover, a direct communication will be at once opened with the continent. In addition to this, London can then be supplied with fish with much greater expedition than at present; and from the farmers near the line having an opportunity of conveying their stock to London with great facility, of course the prices of the various necessaries of life will be much reduced in the Metropolis. The steam-boats also, which experience so much difficulty in passing up the Pool, particularly at night time, will most probably disembark their passengers at Deptford Pier, and thus many of the accidents that are so frequently occurring, from small boats and barges being run down by steamers in the Pool, will be prevented. In addition to this, many of the inhabitants of London will be able to live a little way out of town; saving in rent, as much as they will expend in paying for their passage, and having the advantage of sleeping in the country.

The Railway has been constructed under the superintendence of George Landmann, Esq., engineer, by Mr. M'Intosh, the architect; and great praise is certainly due to them for the skilful manner in which it has been completed.

The opening of the line was to have taken place on Tuesday, the 1st of Nov., but in consequence of the iron work of the bridge over Bermondsey-street not having arrived in time, this interesting event is postponed for a few days. When it does takes place, we shall have the pleasure of presenting our readers with an exact representation of the entrance of the Railway as it appears on the occasion. The drawing will be taken on the spot by an eminent artist.

## THE HUMAN BODY.

FIRST ARTICLE.

A DISTINGUISHING characteristic of all living beings, is, that the particles of matter of which their bodies are composed, are in a constant state of change. It appears that matter—the term given to every thing appreciable by the senses—can only retain life for a certain definite period; and hence every living thing, animal and vegetable, must, at one time or another, cease to exist: it must die, and the elements of which it is composed, will combine in different proportions to form a part of other animals or plants. It must not be supposed from this, however, that the same matter which forms the organized body while young, will continue a constituent part of it, and alive, until life becomes entirely extinct. Such an opinion would be exceedingly erroneous. A living body

does not continue exactly the same for two moments together. A continual change is taking place in it: old particles of matter, that have become unfit for the purposes of life, are being thrown off from the body, and fresh matter is being assimilated to supply their place. The power by which this process is conducted is peculiar to living beings, and distinguishes them from unorganized or dead matter, which has no such power.

We intend to confine our remarks on this subject to the human body, and shall only notice the lower species of animals, as illustrations. We therefore omit all mention of the manner in which the function is performed in animals below man in the scale of existence, and proceed at once to describe some of the more remarkable circumstances connected with the physiology of our own bodies. In doing this we hope to be able to prove to every reader of The Penny Mechanic, with the assistance of wood-cuts, how highly interesting is the study of his own frame, and how essentially necessary it is that every one who wishes to preserve his health, should know something about it.

It has just been said that the particles of which all living beings are composed, are in a continual state of change. This holds true with respect to man as well as with respect to other beings. Our bodies are not the same bodies now, that they were three months ago, or even three hours ago. A great portion has changed its structure: it has become unfit for the purposes of life; is being gradually conveyed out of the system; has been dissipated in the atmosphere, and its place supplied by the food we have partaken of since. A person who has never thought upon the subject will probably be surprised to learn, that he loses between four and six pounds weight, every twenty-four hours, by perspiration alone, and that this takes place in winter, as well as in summer; but such really is the case.

Perspiration is of two kinds—perceptible and imperceptible. The perceptible perspiration is that which bedews the body after strong exercise, and is generally termed sweat; the imperceptible perspiration is so called because we do not perceive it so palpably as we do the former. If any one, however, places his hand for a few moments on a looking-glass, he will then be able to observe it, as it will form a slight moisture on the glass. Now, when it is recollected that this perspiration is being constantly given off from the whole surface of the body, night and day, it will not appear so surprising that we lose so much from this cause. Another source of waste is the vapour from the lungs. This, though trifling in quantity each time the breath is expired, or driven out of the chest, amounts to a considerable quantity in the course of twenty-four hours. Messrs. Lavosier and Seguin made a series of very accurate experiments, to determine the exact waste of the body from these two causes. They proceeded as follows: — Having divested themselves of their clothes, they were inclosed in a varnished silk bag, with no opening except a small place to breathe through, and which orifice was glued round the mouth, so that all the perspiration from the body was of course prevented from escaping into the atmosphere. Before entering the silk bag, the experimenters were accurately weighed, and the exact weight of the bag was also ascertained. After they had been inclosed for an hour, they were taken out, and again weighed. It was found they had lost a certain weight, and, in weighing the bag, it was found to have gained not quite as much. After many experiments, it was from this concluded, that the difference between the amount lost by the body, and gained by the bag, must have been given off in vapour from the lungs. Lavosier and Seguin therefore state, that the average loss every twenty-four hours by perspiration from the body, and by the halitus, or vapour from the lungs, is about the quantity just mentioned. At different periods of the year, and even of the day, there is a slight difference, but the above may be considered a fair average.

The loss by insensible perspiration is much greater than by what is commonly termed perspiration, which is only an accumulation of the former. If a person looks closely at his hand,

even with the naked eye, he will perceive on the little ridges which run across it, rows of very minute orifices. It is through these that the perspiration is given out, and they are as numerous over the whole surface of the body, as they are on the hand. When the hand is warm, the perspiration oozing from them may be seen to glitter in the sun; and the little black spots, about the size of a pin's head, which frequently show themselves on the chin, and about the face, and which, when pinched, discharge what is frequently believed to be an insect, are nothing more than accumulated perspiration in these little vessels. Another example may be found in the circumstance that some persons have a peculiar odour, particularly when they get warm; this is caused by the imperceptible perspiration. It is the same with many of the lower animals, particularly those which are carnivorous, or feed on flesh. Every one who has visited a collection of wild beasts, must have perceived it. Again, it frequently happens that thin persons require more food than others who are much fatter. This is principally in consequence of the former losing more substance by the means we have been describing. Anxiety and deep thought also generally cause the function to be more active. Shakspeare noticed this fact. In the play of Julius Cæsar, he makes Cæsar say, "Yon Cassius hath a *lean and hungry* look; he *thinks* too much. I would that he were fatter:" and again, "Let me have men about me that *are fat; sleek-headed men,* and such as sleep o' nights."

When perspiration is suddenly checked, indeed, whenever it is stopped at all, it produces one of the most dangerous maladies—because the most neglected—of any to which the people of this country are subjected—we mean a common cold. It is in order to promote perspiration, when persons are suffering from this, that they are recommended to put their feet in warm water, and take "slops." And the only chance spirits-and-water have of curing a cold, is by exciting perspiration. They sometimes do this, but more frequently fail, and make the patient worse than he was before he drank them. We are not, however, going to dilate on any of the "ills that flesh is heir to;" we propose only to give a simple description of the physiology, not of the pathology, of the body, and the reader must excuse us for digressing thus far. It may be mentioned, however, before quitting the subject of perspiration, that the waste of the body, from this cause, is fearfully seen at the commencement of that dreadful disorder, consumption, when the bed of the unhappy patient is often completely saturated with it. Two-thirds of the people of England are said to die of consumption; and, in every three cases out of four, it is occasioned by a neglected "cold."

Having thus described some of the principal causes which are constantly operating to remove excrementitious matter from the body, and which in the course of from three to four years, change every portion of the human frame, so as to make us entirely different beings; we shall in our next paper commence the subject of digestion—the function by which the food we eat is prepared to supply the place of the matter lost, by the means we have been describing.

## THE VAUXHALL BALLOON.

This balloon has ascended several times merely to gratify the curiosity of the inhabitants of the metropolis; on Monday last it ascended for a more useful purpose, viz., to make an experimental voyage, and, if possible, to cross the Channel, and descend on the continent. Mr. Green had for some time resolved to endeavour to accomplish this object, but the time when the experiment should be made, if it were fixed at all, was kept quite secret. On Monday morning the weather proving favourable, and the wind blowing in the desired direction, it was determined that the ascent should take place that day. Accordingly, at seven o'clock in the morning the inflation of the balloon commenced, and by about one o'clock all was ready for the aeronauts to proceed on their voyage. At twenty-six minutes after one, three gentlemen, Messrs. Green, Monck Mason, and Holland, entered the car, and the bal-

loon directly ascended. Very few persons were about the gardens, in consequence of the proceedings not having been made public. The appearance of the balloon as it rose was finer, we think, than on any previous occasion; it appeared quite full of gas, and the colours of the silk were seen to great advantage. Above a ton of ballast was placed in the car, and the balloon may therefore continue up a very long time, by relieving it gradually of this weight. It was not intended, however, to continue any very great length of time in the atmosphere, although the voyagers provided themselves with every thing it was thought probable they might require during the time they continued there, such as ham, fowls, brandy, &c., also some cold coffee, to warm which, they took with them a quantity of unslack lime. In order to provide against accidents, in case they could not descend while daylight continued, they had a number of blue-lights with them, which they could ignite, and throw out of the car, and by the light thus obtained, learn the nature of the country the balloon was passing over. Mr. Green and his friends were also provided with passports, and a letter to the King of Belgium from the Embassy in London. It was expected that the balloon would most likely reach the French coast by about six or seven o'clock; but this is entirely matter of conjecture, as it is impossible to say what currents of air it might meet with which would either facilitate or retard its progress.

Since the above was written, the Mayor of Dover has addressed a letter to the proprietors of Vauxhall Gardens, inclosing one from Mr. Green, which was thrown out of the balloon into Dover, about five o'clock on Monday afternoon. The balloon was then proceeding in a S. E. direction, and at dusk hung out a light from the bottom of the car. The *Morning Chronicle* of Thursday states, that the aeronauts descended at St. Omers, France, at seven o'clock on *Tuesday* evening. This is most probably a misprint for *Monday*, as we do not suppose Mr. Green remained up all night.

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### FRUITS OF CIVILIZATION.

In England a man of small fortune may cast his looks around him, and say with truth and exultation, "I am lodged in a house that affords me conveniences and comforts which even a king could not command some centuries ago. Ships are crossing the seas in every direction, to bring me what is useful to me from all parts of the earth. In China, men are gathering the tea-leaf for me; in America, they are planting cotton for me; in the West-India Islands, they are preparing my sugar and my coffee; in Italy, they are feeding silk-worms for me; in Saxony, they are shearing the sheep to make me clothing; at home, powerful steam-engines are spinning and weaving for me, and making cutlery for me, and pumping the mines, that minerals useful to me may be procured. Although my patrimony was small, I have post-coaches running day and night, on all the roads, to carry my correspondence; I have roads, and canals, and bridges, to bear the coal for my winter fire; nay, I have protecting fleets and armies around my happy country, to secure my enjoyments and repose. Then, I have editors and printers, who daily send me an account of what is going on throughout the world, among all these people who serve me. And in a corner of my house, I have Books! the miracle of all my possessions, more wonderful than the wishing-cap of the Arabian tales; for they transport me instantly, not only to all places, but to all times. By my books, I can conjure up before me, to vivid existence, all the great and good men of antiquity; and for my individual satisfaction, I can make them act over again the most renowned of their exploits: the orators declaim for me: the historians recite: the poets sing: and from the equator to the pole, or from the beginning of time until now, by my books, I can be where I please." This picture is not overcharged, and might be much extended; such being God's goodness and providence, that each individual of the civilized millions that cover the earth, may have nearly the same enjoyments as if he were the single lord of all.—*Dr. Arnott.*

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### THE AURORA BOREALIS.

In our last we noticed the circumstances which attended the appearance of the aurora in the metropolis. We could not then afford room for a description of the phenomenon itself, but, as it is highly interesting, we now add the following particulars:—

In northern countries the aurora borealis is constantly visible during the winter evenings, and is frequently termed, from this circumstance, the northern lights. When they appear in this country it is generally during the spring and autumn, but very rarely with that splendour which distinguishes them when seen near the North Pole. The most remarkable appearance of them in England took place about thirty years ago, of which a very accurate description has been given by Dr. Dalton; and as this will give our readers a very good idea of the phenomena, we quote from it. He says, his attention was first excited by a remarkable red appearance of the clouds, which afforded sufficient light to read by at eight o'clock in the evening, though there was no moon:—

"From half-past nine o'clock till ten P. M., there was a large, luminous, horizontal arch to the southward, almost exactly like those we see in the north; and there was one or more concentric arches northward. It was particularly noticed, that all the arches seemed exactly bisected by the plane of the magnetic meridian. At half-past ten o'clock, streamers appeared very low in the S. E., running to and fro, from W. to E.; they increased in number, and began to approach the zenith, apparently with an accelerated velocity; when, all on a sudden, the whole hemisphere was covered with them, and exhibited such an appearance as surpasses all description. The intensity of the light, the prodigious number and volatility of the beams, the grand intermixture of all the prismatic colours in their utmost splendour, variegating the glowing canopy with the most luxuriant and enchanting scenery, afforded an awful, but at the same time the most pleasing and sublime spectacle in nature. Every one gazed with astonishment; but the uncommon grandeur of the scene only lasted about one minute; the variety of colours disappeared, and the beams lost their lateral motion, and were converted, as usual, into the flashing radiations; but even then it surpassed all other appearances of the aurora, in that the whole hemisphere was covered with it. Notwithstanding the suddenness of the effulgence at the breaking out of the aurora, there was a remarkable regularity in the manner. Apparently, a ball of fire ran along from east to west, and the contrary, with a velocity so great as to be barely distinguishable from one continued train, which kindled up the several rows of beams one after another: these rows were situate before each other with the exactest order, so that the bases of each row formed a circle crossing the magnetic meridian at right angles; and the several circles rose one above another in such sort, that those near the zenith appeared more distant from each other than those near the horizon, a certain indication that the real distances of the rows were either partly or exactly the same. And it was farther observable, that during the rapid lateral motion of the beams, their direction in every two nearest rows was alternate, so that whilst the motion of the one row was from east to west, that of the next was from west to east."

The cause of the northern lights is unknown. It is supposed, and there are some facts which apparently support the hypothesis, that they are to be attributed to the passage of electricity through the higher regions of the atmosphere. At present, however, the subject is involved in much obscurity; and from the very few opportunities philosophers have of seeing the aurora, it is extremely difficult to obtain accurate data to reason upon.

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On the Study of Natural Philosophy.—There is no occupation which so much strengthens and quickens the judgment as the study of natural philosophy. This praise has usually been bestowed on mathematics; yet a knowledge of abstract mathematics existed with all the absurdities of the dark ages; but a familiarity with natural philosophy, which comprehends mathematics, and gives tangible and pleasing illustrations of the abstract truths, seems incompatible with any

gross absurdity. A man whose mental faculties have been sharpened by acquaintance with these exact sciences, in their combination, and who has been engaged, therefore, in contemplating *real relations*, is more likely to discover truth in other questions, and can better defend himself against sophistry of every kind. We cannot have clearer evidence of this, than in the history of the sciences, since the Baconian method of *reasoning by induction* took the place of the visionary *hypothesis* of preceding times.—*Dr. Arnott.*

*How to extinguish a fire in a Chimney.*—So many serious fires have been caused by chimneys catching on fire, and not being quickly extinguished, that the following method of doing this should be made as generally known as possible:—Throw some powdered brimstone on the fire in the grate, or ignite some on the hob, and then put a board or something in front of the fire-place, to prevent the fumes descending into the room. The vapour of the brimstone ascending the chimney, will then effectually extinguish the soot on fire.

*Power of the Steam Engine.*—One of the largest steam engines yet constructed is that at the United Mine in Cornwall; it can raise 80,000 lbs. 100 feet high per minute; and to effect this enormous labour it only requires about 30 lbs of coal for the same period of time. A labourer, working ten hours a day, cannot, at most, raise more than 3,750 lbs. *one* foot high per minute. The immense importance of the steam engine, merely on account of its being able to concentrate its immense power in so small a space as the engine occupies, will at once be evident on comparing the preceding statements.

## INSTITUTIONS.

Botanical Society.—A general meeting of the members of this Society, and others interested in its objects, took place at the Crown and Anchor Tavern, Strand, Nov. 3rd, G. C. Grey, Esq., F. R. S., in the chair. This meeting was well attended, and we are happy to state, that some ladies eminent in botanical science were present, and took great interest in the business of the meeting. Several donations of books, and specimens of plants were announced; new members admitted Fellows of the Society; and an ably-written paper was read by D. Cowper, Esq., author of the *Flora Metropolitana*, on the growth of the common broad bean. The next meeting will be held on the 17th instant.

Zoological Society.—The number of visitors to the Museum of the Society during the last month, has been 325, and to the Gardens 8751. The Museum has been removed from Burton-street, to Leicester-square.

Meteorological Society.—This Society is about to be revived. A meeting will be held on Tuesday evening, the 15th instant, at 8 o'clock, in the committee-room of the London Mechanics' Institution: Dr. Birkbeck, the President, will take the chair.

### LECTURES DURING THE WEEK.

*London Institution*, Finsbury Circus.—Monday Evening, Nov. 14, at Seven o'clock, W. T. Brande, Esq., on Chemistry. Thursday, at One o'clock afternoon, Mr. Chalklen, on Taste.

*Western Literary and Scientific Institution*, 47, Leicester-square.—Thursday, Nov. 17, at half-past Eight, Mr. Cowper on Engraving and Paper Making.

*London Mechanics' Institution*, Southampton-buildings, Holborn.—Friday, Nov. 11, at half-past Eight, Rev. W. J. Fox, on the Study of the Philosophy of the Human Mind.—Wednesday, Nov. 16, at half-past Eight, Dr. Ritchie on Optics.

*Lambeth Literary and Scientific Institution*, Waterloo Bridge-road,—Tuesday, Nov. 15, at half-past Eight, Dr. Ritchie on Dynamics.

*Islington Literary and Scientific Society.*—Thursday, Nov. 17, at Eight o'clock, Mr. Elliott, on the Education of the Senses.

*Eastern Literary and Scientific Institution.*—Tuesday, Nov. 15, at half-past Eight, Mr. Hemming, on Chemistry.

*Southwark Literary Society.*—Wednesday, Nov. 16, at half-past Eight, T. R. Jones, Esq., on Natural History.

*Mutual Instruction Society*, 16, Great Tower-street, City, Monday, Nov. 14, at Eight o'clock, Mr. Neesom—Essay on Predestination.

### TO CORRESPONDENTS.

We are much obliged to "W. F. G. W." for the Acrostic, but we must decline communications of this nature.

"Mr. White," will see we have made use of his Letter. We shall be happy to hear from him.

"A Friend" is perhaps not aware of the difficulty of correcting the press; we receive his observations, however, with thanks.

All communications for the Editor to be left at the Publisher's.

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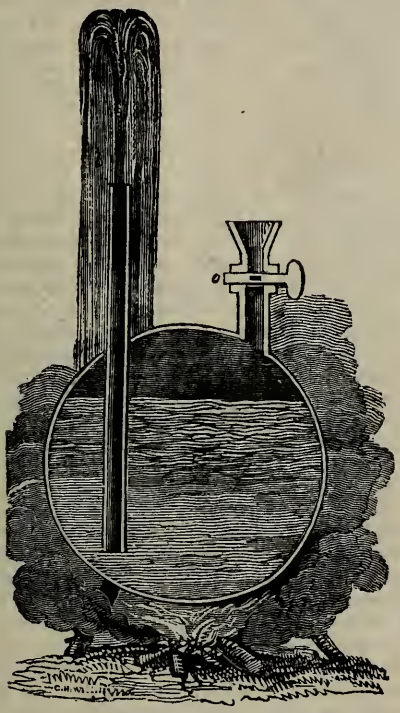
# THE PENNY MECHANIC.

A MAGAZINE OF ARTS AND SCIENCES.

No. III.] SATURDAY, NOV. 19, 1836. [Vol. I.

DE CAUS'S STEAM ENGINE.




THE AIR GUN.

FIG.1.

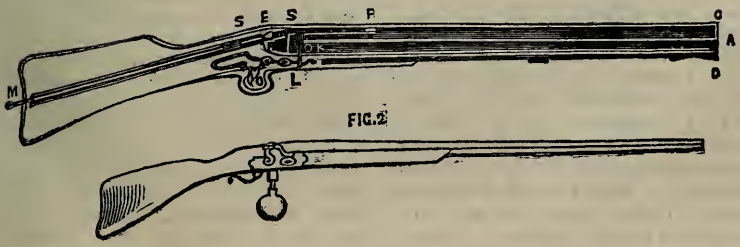



FIG.2



Holloway Press: D. A. Doudney.

## THE STEAM ENGINE.

NO. II.

In tracing the history of the steam-engine, it should be borne in mind that the honour resulting from any invention or discovery is not so justly due to the man who first proposes it, as it is to him who makes a practical application of such invention for the purpose of increasing the enjoyments and the happiness of his fellow-men. In other words, there is far more merit in applying a discovery to purposes of utility, than there is in happening to be the first man to whom the invention may have occurred. There is nothing unjust towards inventors in this mode of reasoning. We are always much obliged to a man for informing us how we may advance ourselves in the world, or increase our prosperity, but we are far more indebted to him who affords us the means of doing so. These remarks apply, we think, particularly to many circumstances connected with the history of the steam-engine. The world is much indebted to the man who first pointed out the fact, that water can be converted into an elastic vapour, and afterward condensed into water again; but it owes much more to Watt and the other improvers of the steam-engine, for their application of this discovery. We must, however, award to every one his due share of praise for assisting in producing the wonderful machine we are speaking of. Dr. Lardner has very properly remarked that the steam-engine, as it at present exists, is not the exclusive invention of any one individual; it is a combination of inventions which, for the last two centuries, have been accumulating. When we attempt to trace its history and to determine its first inventor, we experience the same difficulty as is felt in ascertaining the head of a great river: as we ascend its course, it becomes difficult if not impossible to distinguish it from its tributary streams; and it terminates in a number of threads of water, each in itself so insignificant as to seem unworthy of being called the source of the majestic object which has excited the inquiry. Just so with the steam-engine. The machines that were first invented to act by the power of steam, can no more be compared with the "great mover" of the present day, than can the trickling streams with the mighty river which they assist in forming.

The first person of whom we have any record, who applied the power of steam for the purpose of producing motion, was a Greek philosopher of the name of Hero, who lived about 2000 years ago. He caused a hollow globe, having tubes opening into the atmosphere, opposite each other, to revolve on two upright pillars, by means of an axis; and into this globe he conveyed steam (which was formed in a cauldron or vase underneath,) through one of the pillars that was made hollow, and had its bottom part inserted in the cauldron. The steam made its escape from the globe through the tubes just mentioned, and by this means gave the globe a swift rotatory motion. This machine, which is termed an Œlipile, was about the year 1590, proposed with a slight alteration, by a German writer, as an excellent means for turning a spit to roast meat upon. It does not appear, however, that it was ever applied even to so useful a purpose as this, being in fact nothing more than a philosophical toy, and only deserving mention, because it is the first piece of apparatus to which steam was applied as a moving power.

About the beginning of the seventeenth century, De Caus, a French engineer, proposed to employ the elastic power of steam to raise water. (See our engraving in the front page.) This he effected in the following manner:—He filled a hollow globe nearly full of water, into which a pipe descended above half-way down, and opened through the top into the atmosphere. He then applied heat to the water, and formed steam, which soon occupied the space between the surface of the water and the top of the globe. As the heat was continued, the expansive force of the steam increased, and, having no way to escape, it pressed on the surface of the water, and forced it up the pipe *b*, which we have stated descended into it some depth. As the water was taken away by this means, more was supplied, through another pipe opening into the boiler, furnished

with a stop-cock *o*. This was the earliest application of high-pressure steam with which we are acquainted.

The first person who appears to have applied steam to an useful purpose, was Branca, an Italian. He formed a boiler, which he represented in the shape of a human head and thorax, to which heat was applied, until steam was formed from the water contained in it. The steam was allowed to escape through a tube in the mouth of the figure, and was directed against a wheel, formed with flat boards, or vanes like a windmill. This was driven round by the vapour striking it, and a pinion being attached, motion was by this means given to machinery, which was employed in a pounding mill.

After this period, the properties of steam began to be better known by practical men, and was employed in a variety of ways to raise water in fountains, &c.; but none of them are sufficiently interesting to deserve particular notice in this paper, being little more than specimens of ingenuity misapplied, or unable to produce any useful result.

The next individual whose name is associated with the early history of the steam-engine, is the Marquis of Worcester, a nobleman of the reign of Charles the Second. In 1663 the Marquis published a book which he called, "A Century of Inventions," being an account of one hundred discoveries which he claimed as his own. Amongst the rest, he says,—

"I have invented an admirable and forcible way to drive up water by fire, not by drawing or sucking it upwards, for that must be, as the philosopher calleth it, *infra sphæram activitatis*, which is but at such a distance, but this way hath no bounden, if the vessel be strong enough; for I have taken a piece of a whole cannon, whereof the end was burst, and filled it three-quarters full of water, stopping and screwing up the broken end, as also the touch-hole, and making a constant fire under it; within twenty-four hours, it burst and made a great crack; so that, having a way to make my vessels so that they are strengthened by the force within them, and the one to fill after the other, I have seen the water to run like a constant fountain-stream forty feet high. One vessel of water rarified by fire driveth up forty of cold water, and a man that tends the work is but to turn two cocks, that, one vessel of water being consumed, another begins to force and refill with cold water, and so successively, the fire being tended and kept constant, which the selfsame person may likewise abundantly perform in the interim between the necessity of turning the said cocks."

This description is supposed by some persons to have given the first idea for the many and great improvements that were afterwards made in the construction of the steam-engine. Other persons, on the contrary, deny that any very great praise is due to the Marquis, because he does not state in what manner the engine is to be constructed; and, as no proof has ever been adduced that he formed one himself, they consider his invention entitled to very little respect. In our next paper on this subject, we shall enter more particularly into the merits of the Marquis's invention.

## THE AIR GUN.

The atmosphere in which we live is an elastic fluid. A portion of it can be compressed, so that it shall not occupy a twentieth or a fortieth part the space it naturally fills, and yet, on the removal of the pressure by which this condensation has been effected, the air will expand to its original volume. There is a continual tendency in condensed air to do this, and the expansive power or force with which the air endeavours to regain the space it previously occupied, will of course depend upon the degree to which it is condensed. This is the case with all elastic bodies. If we employ a slight force to bend a piece of steel watch-spring, it will have a recoil equal to the power employed in bending it. If we employ a greater force, the result will be the same; and this holds true, not of a watch-spring alone, but of all elastic bodies, and amongst the rest, of the air. It is in order to make available this property of the atmosphere that the air-gun is constructed. The engraving, fig. 1, represents a section of one. It consists of two barrels, one from which the bullets are driven, A, and a large barrel, E, C, D, L, on the

outside of it. There is a syringe, S, M, fitted in the stock of the gun, by which the air is injected and condensed in the cavity between the two barrels, through the valve E P. The ball K is put down into its place, in the small barrel, with the ramrod, as in any other gun. At L, is another valve, kept down by a spring seen at F, which valve, being opened by the trigger O, permits the air to come behind the bullet so as to drive it forwards. If this valve be opened and shut suddenly, one charge of condensed air may be sufficient for several discharges of bullets; but if the whole air be discharged on one single bullet, it will drive it out with a greater force. This discharge is effected by means of a lock, placed as in other guns: for the trigger being pulled, the cock will go down and drive the lever O, which will open the valve S, L, and let the air in upon the bullet K.

This gun will perhaps best explain the principle on which air-guns are constructed, although, in the present day, this kind is but very seldom used. Great improvement was made in it by Dr. Ellis, by which the air is not condensed in the stock, but in five or six hollow copper balls, about three inches in diameter. These are fitted to a screw on the lock of the gun, and are so furnished with valves as to retain at pleasure the air forced into their cavities, so that they may easily be carried about from place to place, ready charged with condensed air, and the gun itself is rendered as portable as the smallest fowling-piece.

The one most generally in use, however, is that represented by fig. 2. It consists of a common barrel, and under the lock is a round steel tube, having a small moveable pin in the inside, which is pushed out when the trigger is pulled by the spring work within the lock: to this tube a hollow copper ball, charged with condensed air, is screwed on, having a valve opening inwards. It will be seen, therefore, that when the trigger is pulled, the moveable pin in the steel tube is forced suddenly against this valve, thereby opening it, and allowing a portion of the condensed air to escape into the barrel, along which it forces the bullet that has been previously introduced, and thus the gun is discharged. The manner in which the air is condensed we shall take the opportunity of describing more particularly, at some future time, but as several accidents have occurred, in consequence of persons incautiously leaving the copper ball highly charged with condensed air, we think it right to mention, that a portion, at any rate, should always be discharged before laying the gun by. A copper ball may be able to bear the expansive pressure of the air with which it is charged, if the temperature of the ball continue the same, but if it increases—if the ball becomes warmer—of course the atmosphere within it acquires a greater expansive force, which the ball may not be able to withstand. In all cases where a considerable force is required, and consequently a great condensation of air, it will be requisite to have the condensing syringe of a small bore, perhaps not more than half an inch in diameter; otherwise the force requisite to produce the compression will become so great, that the operator cannot work the machine; for as the pressure against every square inch is 15 lbs., and against every circular area of an inch diameter 12 lbs., if the syringe be an inch in diameter, it will require a force of as many times 12 lbs. as the density of the air in the receiver exceeds that of the common atmosphere; so that when the condensation is ten times, the force required will be 120lbs., whereas, with an half-inch bore, it will only amount to 30lbs. Besides the air-guns we have described, there are some others, the particulars of which it was not necessary to mention. In the London Encyclopædia, to which we are indebted for part of the materials for this description, the reader will find the subject treated of more fully, and longer descriptions given than we have been able to give.

## HILL'S ROTARY PRINTING MACHINE.

In the "Repertory of Patent Inventions," for November, there is a very interesting account of this new machine, from whence we have derived the following particulars respecting it:—

The steam printing press was introduced

at the close of the year 1814, before which time all printing was done by hand-presses, and the rate at which large sheets, as newspapers, were printed, scarcely ever exceeded 300 single impressions in an hour. The impressions being on one side only of the sheet of paper. The inconvenience this occasioned will perhaps be better understood, when it is mentioned, that the printers of large newspapers, confined in their operations by the slowness of the hand-press, frequently had no resource, under the pressure of urgent demand, but to set up a portion of their matter in duplicate, at an expense of some thousands per annum. When, however, the machine presses were brought into action a great increase of speed was at once obtained. During the twenty-one years which have elapsed since their introduction, various and important improvements have been effected in their construction, and by the rapid and powerful machines now used in printing the daily newspapers, the surprising number of 4000 single impressions is sometimes given off in an hour. The inventor of the machine which is the subject of this paper, believes that he has effected improvements by which the rate of printing just named, great as it is, may be still further increased, and that in no trifling degree. His machine, being worked by two men, can be made to throw off sheets of the size of the evening newspapers, at the rate of 7000 or 8000 perfect copies per hour. In order to explain the means by which this advantage is proposed to be obtained, it is necessary to notice shortly the construction of the machines now commonly in use. The type necessary to the printing of one side of the sheet, consisting (for a newspaper) of about 100,000 separate pieces, are collected, and being arranged in proper columns, the mass is placed in an iron frame called a chase, which binds it firmly together, and the *form* (as the chase filled with type is technically called) is then transferred to the machine, where it is secured upon a strong iron plate, which plate being mounted upon truck wheels, forms a carriage; and there is a small rail-road for it to run upon. When the machine is in action, this carriage, with the form upon it, of which the face of the type constitutes the upper surface, is constantly moved backward and forward horizontally, and as it passes along, it comes in contact, first, with the inking apparatus, which consists principally of a number of cylindrical rollers covered with ink, and lying horizontally, and which are set in motion by the friction of the surface of the type acting upon their lower sides as it runs under them. Next the *form*, being now inked, passes under a large revolving iron cylinder about the form and size of an ordinary double drum; this lies horizontally, and its curved surface is covered by a closely-wove blanket bound tightly upon it. The paper as it is supplied to the machine, is made partly to encircle this cylinder, being held against it by tapes which move with the cylinder. The surface of the type moving horizontally, and the surface of the blanket-covered cylinder revolving with the paper upon it, have exactly the same speed, and as the type passes under the cylinder, that side of the cylinder which bears the paper is brought undermost, and presses the paper upon the type, whereby it is printed. The cylinder then rises a little, the type returns under it without contact and passes back to the inking rollers for another supply of ink, preparatory to the printing of another sheet; while the printed sheet, if the machine be constructed to hold one form only, now passes out from between the cylinder and the tapes, and is received by an attendant.

Simple and ingenious as this arrangement undoubtedly is, the experienced machinist will at once perceive that much time is lost in consequence of the motion of the *form* (which, with its carriage, weighs from 5 cwt. to a ton,) having constantly to be changed; first to obtain a supply of ink for the type, and then to regain the position proper for printing the succeeding sheet. These defects appear to be unavoidable while the type forms a flat surface, as it is not practicable to make a flat surface move continuously.

Mr. Hill proposes to obviate these defects by affixing the type around a cylinder, so that the surface of the type itself shall form a kind of outer cylinder, the whole resembling slightly an organ barrel with its projecting pins; and he has certainly overcome the principal difficulty as it appears, viz., the discovery of a mode of readily and securely attaching the pieces of type to the cylinder, and this without making it difficult to detach them for the purposes of correction, revisal, &c. According to his plan each piece of type is slightly wedge-like in its form, so that when several are laid side by side, they form a segment or arch, whose lower curve corresponds to the surface of the cylinder upon which the type is to be fixed, and each piece, instead of the ordinary narrow notches in its side, made for the compositors' convenience, has a very broad

notch; when the type is placed together to form a line, these broad notches in the several pieces range together, and form an arched chase capable of receiving a thin brass plate of corresponding form and dimensions, which, when applied, is wholly embedded in the chase. When a line of type, with its plate, or scaleboard, so embedded within its substance, is compressed between the lines, and its plate thereby completely inclosed and kept it its place, it is manifest that no single piece of type can be displaced; if any move the whole line must move. Means have been adopted, which we have not space to describe, by which these plates are made to take their places in the course of the composition, with the utmost readiness and certainty. The lines of the type are placed in a kind of tray or galley, of the length and breadth of a newspaper column; the bottom of which tray is a portion of a cylinder, the curvature being in its breadth, not in its length, somewhat as though a stave were taken from a truly cylindrical cask, and used as the bottom of a tray, the curved side being uppermost. The lines of type are secured in the tray principally by horizontal screw pressure acting against the ends of the column of type; but as a precaution against a tendency to bulge, which sometimes occurs in a column of the great length required in a newspaper, a few of the embedded plates have small projecting tenons at their ends, which lock into certain chases in the sides of the tray just described. The type so affixed upon a cylinder, together with the proper spaces for margin, occupy its whole circumference; the cylinder thus clothed is placed in contact with a blanket-covered cylinder of the same dimensions, and the two are connected by toothed wheels, and the paper is passed between them with moderate compression, just as a piece of metal is passed between the rolls of a flatting mill. An inking apparatus is attached, by which a constant supply of ink is communicated to the type as it revolves. As the type cylinder has affixed to it precisely the quantity of type requisite for printing a sheet on one side; and as there is no vacant space upon the cylinder except for the margins, it follows that at each revolution of the cylinder exactly one sheet will be printed; and that the instant the printing of one sheet is completed, that of another will be commenced; no loss of time therefore can occur if the supply of paper and of ink be kept up. To supply the machine with paper in single sheets, at the rate of two per second, at which rate the machine has hitherto been worked, would be difficult if not impracticable; the plan therefore has been to make use of a long scroll of paper as it is produced by the ordinary paper machines, the end of which being introduced between the rollers of the machine then supplies itself by unwinding the scroll from a reel. It is intended to cut the scroll up into single sheets by additional machinery, as it passes from the printing rollers.

## ATMOS* THE GIANT,
### AND HIS RELATIONS.

Atmos the Giant is one of the last of that formidable race which, in olden time, are said to have infested the earth, and about whom the youthful mind is so edified on the perusal of the "Arabian Nights" Persian Tales, &c. &c., in the present day. His pedigree is extremely ancient, since his father and mother, who are both living, were coeval with the creation. Atmos is their only son, and was probably born in Paradise, at the time when a thick mist covered the surface of the earth at the command of God for the purpose of irrigation. Many, many centuries however elapsed between this event and the discovery of those useful qualities which so eminently distinguish him, and which are now so universally known; and long did he in vain strive to call the attention of man to his ability and willingness to serve him. Often as our forefathers nestled in the chimney corner would his childish treble be heard when the kettle became sufficiently acquainted with the fire, like the chirp of the cricket, or the high-fetched tones of the highland bagpipes; and he himself would soon after be seen issuing from the spout like a true genii in the form of a cloud of smoke. When, however, his praiseworthy efforts were unheeded (which they invariably were), he would manifest his impatience by a rattling noise, shaking whatever covered the water to which the spell which bound him had brought him. His anger was not unfrequently displayed by biting the hands and arms of thoughtless people, especially cooks, with whom he was particularly indignant, because, by the force of the spell, they often compelled the noble individual of the Atmos family to boil potatoes. At length, however, after trials and disappointments innumerable, a man was found, who, by attending to his peculiarities, and especially by observing rigo-

* It will, perhaps, be interesting to our young readers to know that Atmos is the Greek word for vapour, otherwise steam.

rously the conditions of the spell, applied the great irresistible power to more useful, and, at the same time, to more honourable uses. Having therefore succeeded thus far, Atmos appeared in dreams and visions of the night to those to whom this knowledge (for it was soon spread) was imparted, and told them, that if they would observe certain conditions he and his relations would always be ready to assist them; that they would heave up mountains, split rocks into atoms, spin wool and cotton as fine as gossamer, print books, and impel ships against all opposing powers, provided they would constantly feed his old father whose powers of digestion were such that he could live upon coals. These offers were accordingly listened to, and in proportion to the employment which these reflecting men gave to Atmos, the conditions of the spell were better understood.

(*To be continued.*)

## DIVISION OF LABOUR.

The science of Political Economy treats of the production and diffusion of wealth, and has no concern with moral results, excepting so far as these may be connected with any improvement, in the means of obtaining the necessaries or luxuries of life. The object of the Political Economist therefore is simply to ascertain how the greatest amount of wealth may be produced from a given quantity of labour; and it is in this point of view alone, that the division of employment can be said to be beneficial. A man, by confining himself to one simple operation in any branch of science, will undoubtedly become more expert in it, and be able to accomplish more work, than if he had to attend to several. There can be no denying this, but at the same time that a man does so, the more does he approach to the character of a mere machine, and the greater necessity there consequently is, that his leisure time should be employed in cultivating his mind, in order to counteract the pernicious tendency of his occupation.

In Wade's History of the Middle and Working Classes, some interesting instances of the division of labour are given; from amongst them we take the following:

"A workman in the daily practice of one simple business, acquires a dexterity and dispatch which would not be possible were he more variously occupied. Not only is the play of the muscles improved, but each sense and faculty, by concentration of object. A banker's clerk will count over a bundle of notes with ten times the rapidity of another person not used to the employment. Mr. Babbage mentions a clerk of the Bank of England who, upon an emergency, signed his name, consisting of eleven letters, to 5300 notes, during eleven working-hours, and he also arranged the notes he had signed in parcels of fifty each. This affords some idea how the power of execution is increased by the practice of an employment, and its effects on production, especially in piece-work, must be very great. In nail-making, Adam Smith states, a boy brought up to the trade will make upwards of 2300 nails in a day, whilst a common smith, who, though accustomed to handle the hammer, has never been used to making nails, would not be able to make above two or three hundred in a day, and 'these, too, very bad ones.'

"To make 5546 pins, weighing one pound, occupies four men, four women, and two children, rather more than seven hours and a half of time, and the total expense of labour, each being paid according to his skill and the time he is employed, amounts to nearly 1*s.* 1*d.* The ratio of the wages earned per day by the persons so employed, varies from 4½*d.*, the sum paid to the boy who assists in twisting and cutting the heads, to 6*s.*, the sum paid to the man who finishes the most difficult part of the art. Of the seven hours and a half consumed, four are taken up by a woman in heading; rather more than two hours by another woman in preparing, and the remaining hour and a half is spent by the other eight persons in drawing the wire, straightening the wire, pointing and tinning. Now it is obvious that if only one person was employed to make a pin, from the beginning to the end, he must not only have the skill and strength to execute the more easy and simple processes, but those more difficult and laborious. It follows that one half of his time would be spent in putting on the heads—a part of the work only worth 1*s.* 3*d.* a day; while his skill, if better employed, would in the same time produce five times as much. Pins in consequence would be nearly four times the current price; and the reason of their cheapness is a skilful division of labour, an apportionment of the several processes in the trade among men, women, and children, according to the force and ability requisite to the performance of each.

"Watchmaking is another striking illustration of the principle that the division of labour is limited by the extent of

the market, or, in other words, the demand for its products. From the inquiries of a parliamentary committee, it appears there are one hundred and two distinct branches in this trade, each having its separate class of workmen; and that, with the exception of the watch-finishers, whose business is to put together the several parts of a watch, not one of the classes can work at any other than his own particular employment. Now it is plain, if the demand for watches were not at least sufficient to occupy one hundred and two persons, this minute division of occupation could not be supported, and watches would neither be so cheap nor so well executed. The same cause is in operation in almost every department of trade and business: they are all consolidated or divided according as the market is more or less extensive. In a village or small town, for instance, it is common to find the business of a draper, grocer, cheesemonger, and poulterer, all carried on in one establishment, the demand not being extensive enough to maintain a shopkeeper in each line of business. Again, there are some sorts of industry that can be carried on nowhere but in a great city. A porter, shoeblack, or hackney-coachman, can find employment and subsistence in no other place. A village, or ordinary market-town, would be too narrow a sphere to afford them constant occupation.

## MECHANICS' LIBRARY.

*A New English Grammar*, by George King.—Darton and Son.

It is a feature of the age in which we live, that knowledge of all kinds is now eagerly sought after; and even grammar is not thought too dry a study, by young persons who wish, or are obliged to educate themselves. This is evident from the number of works on this subject that are constantly issuing from the press. Amongst those, we have seen few better calculated to assist the learner, or prove useful in the school-room, than the one before us by Mr. King. The different parts of speech are familiarly explained, and the illustrations can easily be understood. He has also added a few general rules in orthography, which will prove exceedingly useful to most persons: altogether it is a very useful little book.

QUERE.—What is the cause of the rise of sap in trees, and is it to be accounted for on the principle of capillary attraction?

*A curious Patent.*—Amongst the patents lately expired, there is one by a perukemaker, which is thus curiously described in the specification: "For a Forensic Wig, the curls whereof are constructed on a principle to supersede the necessity of frizzing, curling, or using hard pomatum, and for forming curls in *a way not to be uncurled;* and also for the *tails* of the wigs, not to require tying in dressing; and further, *the impossibility of any person untying them.*"—Think of any one untying the tail of a judge's or barrister's wig!

## INSTITUTIONS.

*London Mechanics' Institution.*—The fourteenth anniversary meeting will be held on Friday, the 2nd of December next, on the plan of a *converzationi*. The author of "The Mechanics' Saturday Night," will read a portion of a manuscript poem he has lately written, and several other gentlemen will address the meeting. Drawings, models, &c., executed by members will also be exhibited. Persons having any they may wish to have introduced to the notice of the meeting, must send them to the Institution, on, or before the 26th instant.

*Dr. Ritchie's Lectures on Optics*, we intended to have noticed singly, but upon consideration, think it will be better to give a report of them, when the course is finished.

LECTURES DURING THE WEEK.

*London Institution*, Finsbury Circus.—Monday, at seven o'clock, W. T Brande, Esq., on Chemistry. Thursday, at one o'clock afternoon, W. Chalklen, Esq., on Taste.

*London Mechanics' Institution*, Southampton-buildings, Chancery-lane.—Wednesday, Dr. Ritchie, on Optics. Friday, Dr. Birkbeck, on Meteorology; both at half-past eight o'clock.

*Western Literary and Scientific Institution*, 47, Leicester-square.—Thursday, at half-past eight o'clock, W. Chalklen, Esq., on History.

*Lambeth Literary and Scientific Institution*, Waterloo Bridge road.—Tuesday. W. C. Dendy, Esq., at half-past eight o'clock, on Ghost Seeing.

*Islington Literary and Scientific Society.*—Thursday, at eight o'clock, Mr. Gilbert, on the Commerce of Ancient Greece.

*Eastern Literary and Scientific Institution*, 88, Hackney-road.—Tuesday, Mr. Elliott, on the Education of the Senses.

*Mutual Instruction Society*, Great Tower-street.—Monday, at eight o'clock, Mr. Chatterly, on Botany.

TO CORRESPONDENTS.

We are much obliged to our *revising* "Friend" for his suggestions last week. His "*Hue-and-Cry*" ought to be rewarded with a *Fool's-cap*.

We shall be happy to hear from "C." again.

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# THE PENNY MECHANIC.

A MAGAZINE OF ARTS AND SCIENCES.

No. IV.] SATURDAY, NOV. 26, 1836. [Vol. I.

APPARATUS FOR RESCUING DROWNING PERSONS FROM THE ICE.



Holloway Press: D. A. Doudney.

## ACCIDENTS ON THE ICE.

If the man who makes two blades of grass grow where only one grew before, is a benefactor to his species, certainly he who points out the means by which the life of even a single individual can be preserved, is entitled to no slight degree of praise. We have much pleasure in applying these remarks to a communication we have received from a correspondent, in which he describes two methods, that we think will be found practicable, for preventing many of those distressing accidents which so frequently occur, from the sudden breaking in of the ice, while persons are enjoying the delightful recreation of skating. In the Metropolis, where the opportunity for enjoying this amusement so seldom occurs, those who are fond of it too often venture on the ice before it is in a fit state to bear them; the consequence is, that every winter, when there has been a tolerably sharp frost for a few days, the newspapers have to record the fatal effects of the temerity of thoughtless young men, who have sacrificed their lives through their indiscretion. It unfortunately happens, too, that not unfrequently those who exert themselves most actively to rescue the persons who are drowning, are themselves exposed to great danger, and sometimes meet with the same death they were endeavouring to preserve others from. This is in consequence of the very ill-constructed apparatus that at present exists for rendering assistance in cases of emergency of this kind. Indeed, a few poles, a rope or two, and a ladder, or a piece of wicker-work, may be said to comprise the list of means for preventing accidents on the ice. That some more effectual means should be adopted we think no one will deny, and we have therefore much pleasure in introducing to the notice of our readers two plans that have been suggested by our correspondent, which we trust may, at some future time, prove serviceable in rescuing from an untimely end those who would otherwise perish. The following is the communication:—

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*To the Editor of the Penny Mechanic.*

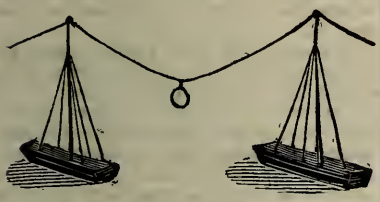
Sir,—As that season of the year has now arrived when we may naturally expect our ponds and rivers to be frozen over, and as so many fatal accidents occur to our fellow-creatures, who venture on the ice to enjoy the pleasures of skating and sliding, I think it a duty incumbent on every one who can suggest any thing for the prevention of similar occurrences to those which took place last year, on the Serpentine, and the Canal in St. James's Park, to do so.

The means which I have hitherto seen resorted to by the men belonging to the Humane Society have been either ropes, boat-hooks, ladders, or a flat-bottom boat. When a man falls in the ice the hole he makes is seldom more than four or five feet in diameter; a rope, with a noose, (having pieces of cork strung on it to prevent its sinking) is then generally thrown to him; this he puts over his head and works under his arm-pits; he then endeavours to extricate himself by throwing his whole weight on the ice; if it is not sufficiently strong, a large portion gives way, and he is suddenly plunged under the water. The men then pull at the rope; but the force being exerted horizontally instead of vertically, the man is pressed against the edge of the ice, the rope is often broken, and the victim perishes. I saw an instance of this about the year 1817; eight persons fell into the Canal in St. James's Park, near the Pagoda-bridge. A sailor, who had been chiefly instrumental in getting them out, at last fell into the same hole himself. A rope was instantly thrown to him, which reached across the Canal, and was held by persons on each side. The man raised himself, by floating, and laid with his back across the rope, holding on at the same time with both hands; but in endeavouring to pull him out, the ice cut the rope, and he sunk, but soon rose again, and continued swimming for nearly a quarter of an hour, without any one being able to render him assistance. At length a gate was taken from the Park fences, and carried to the top of the Pagoda-bridge, which was thrown to him to lay hold of; but it fell on his head, and that which was intended for his rescue proved the cause of his death.

Instead then, Sir, of an horizontal apparatus, I propose, in the first place, a triangle, formed of poles, each about sixteen feet long (see first page); these poles to be raised so as to be about eight feet high when over the hole; and to be lashed together near the bottom to prevent their stretching; or they may have cross-pieces, formed of spars, made fast near the bottom, which will keep them in their proper position. The feet of the poles are to be stepped into small pontoons, moveable like castors on the legs of a table, and to be shod with thin slips of iron, to form sledges, and also to give a greater surface for the weight of the poles. At the top of the triangle

there is a block fitted, with running tackle attached to it. When a man falls in the ice, the machine can be slid along by means of the sledges over the hole; and if it should be considered unsafe to keep close to the pontoons, to guide the triangle, ropes are made fast to each of them, so that the men may remain at what distance they please and guide the triangle to the spot. The tackle (fitted with a noose at the end) is then lowered to the individual by one of the Society's men, who is stationed with the coil in his hand for the purpose, which he places under his arm-pits: he is then pulled up, and the machine is guided away to a place of safety, where he is lowered down.

But should the ice be so much broken as to prevent the use of the triangle, and a greater span required, I propose that two boats (as represented in the diagram),



similar to those used by the Society, but larger, should be each rigged with a mast in the centre. On the tops of these masts blocks are to be fastened: a strong line is then to be passed through the block at the top of one mast and passed over to the block on the top of the other, the ends of the rope falling on the ground. This will form a sort of suspension-bridge, which can be heightened or lowered, contracted or expanded at pleasure; and the centre of the line having a noose fitted to it, as before described, it can be lowered with the greatest ease and certainty to the individual in the water.

Should you consider my plans likely to be of any benefit to our fellow-creatures, and give them publicity through the means of your valuable Magazine, you will much oblige, Sir,

Your obedient humble servant,

H. P.

## PERPETUAL MOTION.

*To the Editor of the Penny Mechanic.*

Sir,—Although I am aware it is generally stated, that this much-sought-for result can never be obtained, in consequence of friction, sooner or later, bringing any machine in motion to a state of rest; still I am inclined to think this difficulty might be overcome, if some force could be employed to produce motion in such a way, that the force should always continue the same, and have the same power of resisting friction after the apparatus had been a length of time at work, as it had when the machine was first set in motion.

It appears to me that something of this kind might be effected by means of a syphon. It is well known that if a bent tube, having one end longer than the other, has its shorter end inserted into a vessel of water, and the other end hung over the side, if the air be sucked out of the tube, from the longer end, the water will begin to flow through it from the vessel, and run until the water is on a level with the end of the tube on the outside. This is stated to be in consequence of the column of water, in the longer end, being heavier than that in the shorter, and therefore drawing it down. Now, it has occurred to me, that if the longer end of the syphon was made of twice the diameter of the shorter one, that it then need not be much more than half the length of the short end, and might therefore hang over the water, and instead of drawing it *from* the vessel, deposit it *in it again:* thus there would be a perpetual motion.

I have never had the opportunity of putting my proposition to the test; but as, perhaps, some of your readers may have done so, or, at least, may be able to inform me whether they see any objection to it, in principle, I shall feel much obliged if you will find a corner in your interesting Magazine for this letter.

I am, Sir, your's obediently,

*17th Nov.* 1836. Enquirer.

[We have inserted our correspondent's letter, because it will afford us the opportunity of offering a few observations upon the many unsuccessful attempts that have been made, from time to time, to discover a "perpetual motion." This, if possible, we will do next week. In the mean time we may inform "Enquirer" that there *is* an objection to his proposition, resulting from a law of hydraulics, which, if he is not previously answered, we will explain to him shortly.—Ed. P. M.]

## FRICTION.

The surfaces of all bodies, when viewed through a good microscope, will be found to be full of inequalities, however smooth the surfaces may appear to the naked eye.

Therefore, when two bodies are brought into contact, the minute projections in one fit into the minute cavities in the other; and, consequently, if the bodies are put in motion, their velocity will be much retarded from this circumstance, to which the term *friction* has been applied. The same effect takes place when two bodies are brought into close connexion with each other, from their having a tendency to cohere together.

The influence of friction is so extensive, not only in the mechanical operations that man can control, but also in all the operations of nature, that a person who should neglect it in his calculations, when endeavouring to ascertain the result of any given force, would be guilty of great negligence. It may appear impossible for any one at all acquainted with mechanical philosophy to do so; yet it is quite certain, that not a few of those who have devoted their time to the discovery of a perpetual motion, never thought it necessary to calculate the result of friction; or, if they did, they under-rated it exceedingly. It is, however, the most powerful antagonistic force in nature. Not only does it stop the marble, thrown from the schoolboy's hand along the surface of the ground, but it acts as effectually in bringing to a state of rest bodies put in motion by the most powerful forces in nature.

A few familiar examples will, perhaps, best illustrate the power of friction.

When a coach descends a hill, one of the wheels is fastened, or locked, as it is termed, by which the iron tire is made to rub against the road. The friction this causes retards the velocity of the coach, and makes it descend with but little more rapidity than that with which it would proceed on level ground.

Before an engagement, the sailors on board a man-of-war, place their hammocks against the sides of the deck, in order, as much as possible, to stop the progress of the cannon-balls. One of them striking a hammock is brought to a state of rest by the friction produced in its passage through the bed.

If a billiard-ball is thrown upon the ice, it will proceed to a far greater distance than if bowled along the ground. The reason is, that in the latter case there is more friction to be overcome than in the former.

A carriage placed upon a railway can be moved with a very slight degree of force to what is required to put it in motion on a common road, where the friction between the wheels and the earth is much greater than it is on the railway. Although, as will be frequently seen, there is a greater cohesive force in the latter case. When locomotive steam-carriages were first proposed to be adopted in this country, it was thought that the friction between the wheels and the road would not be sufficient to enable the carriage to proceed. That, in fact, when the engine was put in motion, the wheels would merely revolve, without going forward. Accordingly, Mr. Gurney, who first proved the practicability of employing the steam-carriage on common roads, wasted much labour and skill in the contrivance of levers and propellers, which acted on the ground in a manner somewhat resembling the feet of horses, in order to drive the carriage forward: while, if he had previously made the experiment, he would have found, as he subsequently did, that the friction between the road and the rim of the wheel, was quite sufficient, not merely to enable the carriage to proceed on level road, but actually to ascend hills, where the inclination increased one foot in nine.

The above are a few illustrations of the influence of friction. As it acts so powerfully in diminishing the effect of all kinds of force, mechanics have always paid considerable attention to the best means of diminishing it. Rubbing surfaces, in all well-constructed engines, are avoided as much as possible: and when this cannot be done, the parts are kept well lubricated with oil, or other unctious matter, which facilitates the motion of one body upon another. It is also found, that if the substances which rub each other are of different kinds, the friction is considerably diminished. Ferguson, who made a variety of experiments to elucidate this point, found, that while the friction of polished steel, moving on brass, was only equal to *one sixth* of the weight of the rubbing substance, the friction of two pieces of soft wood was equal to *one third* the weight. In the construction of carriages this circumstance is taken advantage of. The axles of the wheels are formed of steel, and the parts they rub against are formed of brass. In watches, too, if the steel axles play on a diamond, the watch becomes far more valuable for its accuracy, as well as for the intrinsic worth of the diamond. Friction-wheels are also frequently used in machinery, for the purpose of diminishing the effects of friction. They consist of wheels, on which the axis of another wheel revolves.

The quantity of friction is always proportional to the *weight* of the substance moving upon another, and not to the *quantity* of surface, as might at first be sup-

posed. It has also been found that friction increases with an increase of velocity, although it is not proportional to the increased celerity with which a body moves.

It must not be supposed, because friction has a tendency to destroy motion, that it is therefore prejudicial. "Were there no friction, all bodies on the surface of the earth would be clashing against one another; rivers would dash with unbounded velocity, and we should see little besides collision and motion. At present, whenever a body acquires a great velocity, it soon loses it by friction against the surface of the earth; the friction of water against the surfaces it runs over soon reduces the rapid torrent to a gentle stream; the fury of the tempest is lessened by the friction of the air on the face of the earth; and the violence of the ocean is subdued by the attrition of its own waters. Its offices in works of art are equally important. Our garments owe their strength to friction; and the strength of ropes, sails, and various other things, depend on the same cause: for they are made of short fibres, pressed together by twisting: and this pressure causes a sufficient degree of friction to prevent the fibres sliding one upon another. Without the friction, it would be impossible to make a rope of the fibres of hemp, or a sheet of the fibres of flax; neither could the short fibres of cotton have ever been made into such an infinite variety of forms as they have received from the hands of ingenious workmen. Wool also has been converted into a thousand textures for comfort or for luxury, and all these are constituted by fibres united by friction. In fine, if friction retards the motion of machines, and consumes a large quantity of moving power, we have a full compensation in the numerous and important benefits which it ensures to us." So it is with nearly every other operation of nature; the same cause which at one time may produce much temporary evil, at another time will be productive of permanent and extensive good.

## ATMOS THE GIANT.

NO. II.

Though Atmos had shown himself so obsequiously obliging, he had also given undeniable proofs, not to be mistaken, that he was not to be trifled with. He partook very much of that John Bull sort of disposition so common at that time in the country where he was taken most notice of; that is, though willing, nay, anxious, to remain in his proper place as the servant of man, yet he was likewise possessed of a deep and abiding sense of his own merits, and a sturdy determination to resent, to the utmost, every encroachment upon his rights. A striking, but most appalling instance of this occurred soon after he began to be in favour. A young man, perfectly acquainted with the conditions of the spell, ordered one of the giant's family to cook his dinner; the young giant appeared immediately, and proceeded to do as he was bid. However, his employer, on being "sharp set," and desiring to hurry him, broke the rules, stopping forcibly a hole out of which he was breathing, and for his temerity was punished in the most summary manner with instant death; thus affording a terrific example of the nervous irritability of Atmos under oppression. The fearful vengeance which the giant took on this occasion procured him more respect even than usual, and the magicians who employed him proceeded to act with more caution: in fact, it was even contemplated by some to give him up altogether, as being too dangerous a servant for so feeble a master as man. While, however, this important matter was in agitation, and his employers were debating, pro and con, upon the subject, one of them, more sagacious than the rest, extricated them at once from the necessity of discontinuing his valuable services; informing them that he had discovered a method by which the giant's rising anger might be pacified without the intervention of man. Overjoyed at this intelligence, they willingly availed themselves of it, and now proceeded with greater ardour to prosecute their studies; each in general striking out different and untrodden paths, and raising his own fabric on the foundation of principles common to all.

It shall now be our task to follow the principal of them, and to give an account of the discoveries they made in common with the profitable employment of this new species of labour, and this we propose to do under so many heads or chapters.

### *Atmos employed by an Apothecary.*

A magician of Italy, who was also an apothecary, having studied the temper of the giant, conceived it possible to persuade him to pound some drugs for him in a mortar, as he found it to be very hard labour, and knew the giant to be much stronger than he. Proceeding, therefore, with due caution, he made some advances to him, just to sound his disposition; and

finding him subservient to his wishes, he acted with greater boldness; in fine, he plainly asked Atmos if he would condescend to blow a wheel, (provided with a sufficient number of floats), round with his breath. The giant replied that he would, if he would allow his father (he made no request for himself) a sufficient quantity of food, and by no means stint his aged parent of his allowance. To this arrangement the Italian readily consented, and proceeded with diligence to make ready the apparatus with which Atmos condescended to work; which being erected, the spell was used, and the giant, true to his word, speedily appeared to set the whole in motion; and the magician soon found that the better the father was fed the better the son (a pattern for all sons) worked in return; and whenever the former was in the least pinched in his stipend, the latter, just in the same proportion, flagged and grew weary, which was immediately remedied by supplying the deficiency. The drugs which he pounded were found fully equal to those pounded in the ordinary way, and his praise was in the mouths of all who witnessed his wonderful performances, which was the case with no small number. But flattering as this homage to his abilities was, he was not in the least affected by it, for he was a being that seemed to be incapable of pride; he still moved on in the same dogged stern old Roman way as ever, rendering no thanks for his wages, and caring for none in return for the feats he performed; night and day would he labour, if required, without the least grumbling or sign of dissatisfaction. He was always ready to obey the commands and attend to the wishes of his master; the most faithful of all servants; the most affectionate of all children; the most unconcerned of all courtiers, and the most tyrannical of all rebels when he once broke out into insubordination. He was at once a patriot and a slave, obedient to all, yet caring for none; unmoved by the changes of empires, thrones, and dynasties, as by the whistling of the wintry wind; and, in a word, incomprehensible as the native of a world and order of things entirely different from our own.

YOUNGSTER.

## MR. POCOCK'S KITE CARRIAGES.

THIS unique and ingenious invention of Mr. G. Pocock, was witnessed by many of the members of the British Association, lately, on Clifton and Durdham Downs, near Bristol, and called forth their unqualified approbation. The starting-place was opposite the Observatory. The car, containing four persons, was drawn by two kites—the pilot kite ten feet in length of standard, the draft kite, twelve feet. The party passed through the turnpike with all the privileges of royalty,* toll free, and proceeding across Durdham Down, ended their journey near Westbury. The general pace was about ten miles an hour. Two days after this first display, four carriages were on the downs, two of which were in constant use for several hours. During the day, about one hundred ladies and gentlemen, many of them foreigners, had an opportunity of riding in these novel vehicles. When the wind was active, the pace was about twelve miles an hour. Many of the gentlemen present expressed their surprise at the power of the kites, and were especially gratified at witnessing the scientific management of them, for they had not conceived that every angle or obliquity of surface could be given to the kites which can be presented to the wind by the varied setting of a sail, or the mast of a boat. From this discovery many judicious remarks were made on the various use to which these kites, or buoyant sails, might be applied. Ideas, new even to the author of the invention, were suggested. The general impression was, that it was peculiarly well adapted for sea service, especially in case of shipwreck, as life preservers, as auxiliary sails, and for the making of signals. It is hoped, therefore, that this hitherto-uninvestigated branch of science will be more fully developed, and applied to beneficial purposes. The most mortifying occurrence of the day was, that, after Lord Courtenay had minutely examined the whole apparatus, and tried every brace line with his own hand, in order to prove its use, and to ascertain the effects produced on the kites, when his lordship had taken his seat for a ride, the wind became so feeble that the general pace was not more than six miles an hour.

On a subsequent occasion an immense

* Mr. Pocock may, in fact, claim a royal appellation for his car, Prince George of Cumberland having had a seat in it, and "handled the ribbons" of the aerial steeds.

kite, of thirty feet length in the standard, was exhibited on the Downs, the power of which was adequate to the drawing of four carriages laden with persons. The most speedy rate of the carriages was eighteen miles an hour.

Though not scientific, to start a new theory as to the applicability of these kites, we were delighted with the control which Mr. Pocock possesses over a team elevated some hundred yards above him. By means of reins (or, as he terms them, brace), he is enabled to bring the kites round to any one point, even almost to a right angle with the road he is travelling, and can put them to an edge with the wind, or allow them its full force. Even the tail is pressed into the service of propulsion, being a series of linen cones, each of which catches what sailors so often long for, "a cap full of wind."

## CHARRING OF ANIMAL SUBSTANCES.

A pamphlet published at Florence gives an account of a strange discovery by Girolamo Legato, the accuracy of which is attested by the principal professors in that city. It appears that Legato, while traversing the deserts of Africa, in 1820, for the purpose of perfecting his map, discovered in one of the hollows which a whirlwind had ploughed up, a completely charred human body, the flesh and bones of which were in good preservation. It struck him that the process of charring could only have been effected by the scorching sand, and that if the heat of the sand had, in this instance, effected the complete desiccation and carbonization of animal substances, it might be possible to effect something similar by artificial means. On his return to Italy he commenced his experiments, and at length succeeded in imparting to the limbs and bodies of animals solidity and indestructible durability; by this process, whole bodies, as well as individual parts, acquire a thoroughly firm consistence, which is more decided according as the respective parts are harder or softer. The skins, muscles, nerves, veins, fat, blood, all undergo this change without its being necessary to remove the intestines, which assume the same consistence. At the same time the colour, form, and character in general, remain unchanged; no smell is perceptible, and both joints and limbs remain flexible and moveable, as when alive; when bodies have acquired this consistency, neither damp, air, moths, nor water, can affect them. The weight is but slightly diminished; not a hair is lost; on the contrary, they are rooted more firmly than ever. Birds and fishes lose neither skins, scales, nor colours; and, in like manner, insects and worms remain perfect in every respect. Legato's cabinet contains many specimens of this novel and singular discovery; one of the most remarkable is a table composed of 214 pieces joined together. The observer would take them for so many different kinds of stone, and yet they are nothing more than portions of the human members.

## THE PATENT RETARDER;
### OR, THE TRAVELLER'S SAFEGUARD.

A most satisfactory exhibition of this new and important invention took place during the three former days of the present week, upon Highgate-hill: we say important, for who of our readers at all accustomed to stage-travelling, has not oftentimes been the subject of fear and even of terror, when seated behind spirited horses upon the brow of some fearfully-steep hill, at finding the entire control of them is left in the hands of an inexperienced passenger, or, it may be, some foppish coxcomb, whose *halfpence* to the stage-porter has secured the box-seat, and who fails not, during the temporary absence of the coachman, to "try what the whip is made of," by smacking it right and left, fore and aft, and at every little kindred *puppy-dog* that happens to pass by; and all at the imminent hazard of the lives of his fellow-passengers. We rejoice, however, to state, that by the Patent Retarder the necessity for adopting any dangerous resources is superseded, as the following will show:—

1st.—In descending a hill, the coachman or guard can, without alighting from, or stopping the coach, apply the retarding power to both hind wheels, imperceptible to the passengers; so that the whole pressure of the coach be taken from the horses, the speed of the coach regulated to any rate, or stopped at pleasure at any spot. The retarding power can be ap-

plied equal in effect to an additional draft of several tons.

2nd.—In ascending a hill it is necessary to stop the horses, to enable them to recover the exhaustion occasioned by the severe draft up it; to do which the coach is set across the road, to prevent its running back, and give ease to the horses at the collar; the patent Retarder applied, immediately fixes the coach, allowing the horses to be perfectly free at the collar, with the traces loose; and indeed, if the wheelers were to back, they have not the power to force the coach back with them, without great difficulty.

3rd.—When it is necessary for a coach to stop, and the coachman leaves the box, he places the reins in the charge of a passenger, or else leaves a horse-keeper or his assistant, at the horses' heads, in both cases, numerous accidents have occurred by the horses starting and running away, having nothing but their accustomed load to draw; the Retarder, applied by the coachman when he leaves the box, would effectually secure the coach, as the horses, having to contend against its power (equal to several tons additional draft), would be impeded, and prevented from moving far.

4th.—Frequent accidents occur to passengers when getting up and down a coach, which is occasioned by the horses moving on, or being restless, thereby making the coach unsteady, overthrowing the ladder used by the passengers (females particularly), or causing the passengers who may be using the hind wheel to become alarmed; the Retarder applied, would as effectually fix the coach, and prevent the horses moving as in the last case.

## INSTITUTIONS.

*Meteorological Society*—Dr. Birkbeck, President, in the Chair.—A meeting of the members of this Society, and others favourable to its objects, was held on Tuesday, the 15th instant, in the committee-room of the Mechanics' Institution, 29, Southampton-buildings, Chancery-lane. The Society has been in a state of inactivity for several years, and we anticipate its revival will be hailed with great pleasure by every meteorologist. After the business of the meeting had been ably set forth, at considerable length, by the learned President, Charles Shearman, Esq., was elected Treasurer in the place of Dr. Clutterbuck, who resigned; and W. W. White, Esq., M.B.S., of No. 4, Worship-square, was elected Secretary, in the place of Thomas Wilfred, Esq. It was resolved, "That every gentleman disposed to join the Meteorological Society be admitted on presenting his name to the Society, and paying one guinea (his annual subscription) within a period of three months. Members to be afterwards admitted by the usual mode of ballot." The meeting was then adjourned to the second Tuesday in December, when W. R. Bish, Esq., author of the *Tubulæ Anemologicæ*, will read a paper on the periodical curves described by the wind.

*Botanical Society*, Adelphi Chambers—J. E. Grey, Esq., F. R. S., in the chair.—At a general meeting of the members of this Society, held on Thursday evening at their rooms, 11, John-street, Adelphi, a very interesting paper on local botany was read by A. Irvine, Esq., of Croydon, a very able botanist. In this paper the flora of the vicinity of London was contrasted with the local floras of different localities in England, Scotland, and various continental states.

### LECTURES DURING THE WEEK.

*London Institution*. Finsbury Circus.—Monday, at seven o'clock W. T Brande, Esq., on Chemistry. Thursday afternoon, at one o'clock, W. Chalklen, Esq., on Taste.

*London Mechanics' Institution*, Southampton-buildings, Chancery-lane.—Wednesday, Basil Montague, Esq, on Knowledge, Ignorance, Error, Prejudice, and Reform, at half-past eight. Friday, Anniversary. A *Converzationi*.

*Western Literary and Scientific Institution*, 47, Leicester-square.—Thursday, at half-past eight o'clock, W Chalklen, Esq., on History.

*Lambeth Literary and Scientific Institution*, Waterloo Bridge road.—Tuesday evening, at half-past eight o'clock, Dr. Southwood Smith, on the Animal Economy.

*Islington Literary and Scientific Society*.—Thursday, at eight o'clock, Mr. Elliott, on the Education of the Senses.

*Eastern Literary and Scientific Institution*, 88, Hackney-road.—Tuesday, Mr. Elliott, on the Education of the Senses.

*Mutual Instruction Society*, Great Tower-street.—Monday, at eight o'clock, B. R. Haydon, Esq., Elements of Painting and Sculpture.

### TO CORRESPONDENTS.

We shall have much pleasure in inserting communications from *Mechanics* and others, no matter what their style of composition may be, if their information is likely to prove interesting.

"A." We cannot comply with his request. The Committee of the "Mechanics' Institution" may have acted harshly in the case referred to, but those who feel aggrieved can bring the subject before the whole of the Members at a general meeting.

"A City Apprentice" shall have his queries answered, in a short article next week.

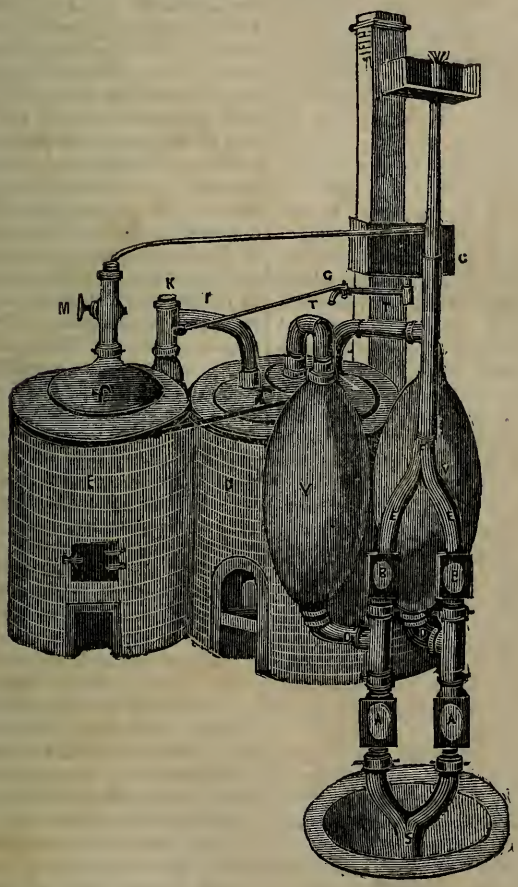
London: Printed at the Holloway Press, by D. A. Doudney; published by Berger, Holywell-street, Strand; and may be had of all Booksellers.

# THE PENNY MECHANIC.

A MAGAZINE OF ARTS AND SCIENCES.

No. X.] SATURDAY, JAN. 7, 1837. [Vol. I.

SAVERY'S STEAM ENGINE.




## THE STEAM ENGINE.

NO. V.

The Engraving above is a very good representation of Savery's steam engine. The circumstances that led to its construction we detailed in our last number, and we need therefore, at present only describe the mechanism and action of the engine. D and E are two boilers, of which D is the larger. From these the pipes T T arise; and through them the steam is sent to the other part



Holloway Press: D. A. Doudney.

of the apparatus. On the top of the boiler, in the *inside* between these pipes a thin piece of metal is affixed, moving on an axis, so that it can be made to cover the opening of either of the pipes inside, and thus cut off the supply of steam. This sliding valve is called the *regulator*. The two cocks on the tops of the boilers, are what are termed *gauge pipes*, and indicate the quantity of water within. This useful piece of apparatus was entirely the invention of Savery. The tube I forms a communication between the principal boiler D and the subsidary or feeding boiler E descending nearly to the bottom of it. This communication can be opened and closed at pleasure by the cock K. From this boiler E a tube extends, which is continued to a cistern C, and a cock placed at M which, when opened, allows the water from the cistern to flow into the feeding boiler E, and which is closed when that boiler is filled. The boiler D is kept constantly supplied with hot water from the small boiler E; the water being forced by the pressure of steam generated in E through the pipe K. Thus far then for the boilers; we shall now, from Dr. Lardner's Lectures, describe the working apparatus.

"Let V V be two steam-vessels communicating by the tubes T T with the greater boiler D. Let S be a pipe, called the suction pipe, descending into the well or reservoir from which the water is to be raised, and communicating with each of the steam-vessels through tubes D D by valves within at A A which open upwards. Let F be a pipe continued from the level of the engine to whatever higher level it is intended to elevate the water. The steam-vessels V V communicate with the force pipe F by valves at B B which open upward, through the tubes E E. Over the steam-vessels and on the force pipe is placed a small cistern C which is kept filled with cold water from the pipe and from the bottom of which proceeds a pipe terminated with a cock G. This is called the condensing pipe and can be brought alternately over each steam-vessel. From this cistern another pipe communicates with the feeding boiler by the cock M. The communication of the pipes T T with the boiler can be opened and closed, alternately, by the regulator already described as within the boiler.

Now suppose the steam-vessels and tubes to be all filled with common atmospheric air, and that the regulator be placed so that the communication between the tube T and the boiler be opened, the communication between the other tube T and the boiler being closed, steam will flow into V through T. At first, while the vessel V is cold, the steam will be condensed, and will fall in drops of water on the bottom and sides of the vessel. The continued supply of steam from the boiler will at length impart such a degree of heat to the vessel V that it will cease to condense it. Mixed with the heated air contained in the vessel V, it will have an elastic force greater than the atmospheric pressure, and will therefore force open the valve at B through which a mixture of air and steam will be driven until all the air in the vessel V will have passed out, and it will contain nothing but the pure vapour of water. When this has taken place, suppose the regulator be moved so as to close the communication between the tube T, and the boiler and to stop the further supply of steam to the vessel V; and at the same time let the condensing pipe G be brought over the vessel V, and the cock opened so as to let a stream of cold water flow upon it. This will cool the vessel, and the steam with which it is filled will be condensed and fall in a few drops of water, leaving the interior of the vessel a vacuum. The valve within the pipe at B will be kept closed by the atmospheric pressure. But the elastic force of the air between the valve at A and the surface of the water in the well, or reservoir, will open A so that a part of this air will rush in and occupy the vessel V. The air in the suction pipe S, being thus allowed an increased space, will be proportionably diminished in its elastic force, and its pressure will no longer balance that of the atmosphere acting on the external surface of the water in the well. This pressure will, therefore, force water up in the tube S until its weight, together with the elastic force of the air above it, balances the atmospheric pressure on L. When this has taken place, the water will cease to ascend. Let us now suppose that, by shifting the regulator within the boiler,

the communication is opened between it and T, so that steam flows again into V. The condensing cock G being removed, the vessel will be again heated as before, the air expelled, and its place filled by steam. The condensing pipe being again allowed to play upon the vessel V, and the further supply of steam being stopped, a vacuum will be produced in V, and the atmospheric pressure on the water in the well will force through the valve A into the vessel V which it will nearly fill, a small quantity of air however remaining above it. Thus far the mechanical angency employed in elevating the water is the atmospheric pressure, and the power of steam is no further employed than in the production of a vacuum. But, in order to continue the elevation of the water through the force pipe F, above the level of the steam-vessel, it will be necessary to use the elastic pressure of steam. The vessel V is now nearly filled with the water which has been forced into it by the atmosphere. Let us suppose that the regulator being shifted again, the communication between the tube T and the boiler is opened, the condensing cock removed, and that the steam flows into V. At first coming in contact with the cold surface of the water and that of the vessel, it is condensed; but the vessel is soon heated, and the water formed by the condensed steam collects in a sheet or film on the surface of the water in V, so as to form a surface as hot as boiling water. The steam then being no longer condensed, presses on the surface of the water with its elastic force, and when that pressure becomes greater than the atmospheric pressure, the valve B is forced open and the water, issuing through it, passes through E into the force pipe F, and this is continued until the steam has forced all the water from V, and occupies its place. The further admission of steam through T is once more stopped by moving the regulator, and the condensing pipe being again allowed to play on V, so as to condense the steam which fills it, produces a vacuum. Into this vacuum, as before, the atmospheric pressure on L will force the water and fill the vessel V. The condensing pipe being then closed and steam admitted through T, the water in V will be forced by its pressure through the valve B and tube E into F, and so the process is continued.

We have not yet noticed the other steam vessel V which, as far as we have described, would have remained filled with common atmospheric air, the pressure of which, on the valve A, would have prevented the water raised in the suction pipe S from passing through it. However, this is not the case; for, during the entire process which has been described in V, similar effects have been proceeding in the other pipe V.

From this account it will be easily understood how Savery's experiment in the tavern might suggest to him the construction of such a piece of apparatus as that we have been describing.

## RAILWAYS.

### NO. II.

When it has been determined to construct a Railway between two places, and where it is expected that the trade in each direction will be pretty nearly equal, it may be done according to either of the two following plans:—

The first, that of variable gradients, consists of a series of planes, more or less inclined to the horizon, along which the engines travel, without any further assistance, except at some of the steepest inclined planes.

The second, which consists of obtaining level gradients, as long as possible; and where it is necessary to change the level, it is done by the intervention of an inclined plane, with assistant engines, either stationary or locomotive. The merits of these two plans we shall now proceed to discuss.

It is asserted, that in a Railway, constructed upon the system of variable gradients, the power necessary to convey goods between the two places will be the same as if the two places were connected by a single plane; or supposing the two extremities of the line to be upon the same level, then the power would be the same as though the whole line were level; but this is not correct, when the inclination of the plane exceeds the angle at which the carriages will roll down of themselves, as I will illustrate:—

FIG. I.

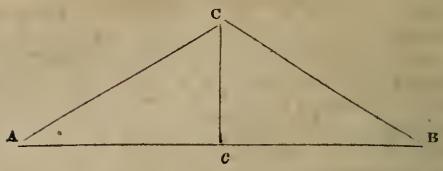
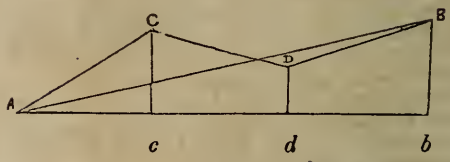



FIG. II.




Thus in fig 1, let A and B be two places, between which it is desirable to form a Railway; but that it is necessary to rise to the elevation of C, and then to descend on the opposite side; let A C, and C B, be each equal to one mile: and the rise, C *c*, equal to 9.5 ft.: then the power necessary to carry 1 ton from A to B will be as follows:—from A to C, 1 mile = 8lbs. friction, + 4lbs. effect of gravity = 12lbs.; from C to B 1 mile, 8lbs. friction, 4lbs. effect of gravity + 4lbs., making 4 + 12lbs. = 16, which is the same as though the road between A and B were level, at the rate of 8 lbs. per ton per mile; because the additional resistance, occasioned by the effect of gravity, in ascending from A to C (4lbs.) would act as a propelling power when the goods descended from C to B, and therefore must be deducted, which would cause the whole power to be 16lbs. for the two miles, or 8 lbs. per mile, as on a level.

Again, in fig. 2, let A and B be the two places; then let A C, C D, D B, each equal one mile; C *c* = 9.5 ft., D *d* — 4.75 ft., and B *b* = 14.25 ft.; then the power necessary to convey one ton of goods from A to B will be as follows:—From A to C, 1 mile, = 8lbs., friction + 4lbs. effect of gravity = 12lbs.; from C to D 1 mile = 8lbs. friction — 2lbs. effect of gravity = 6lbs.; D to B 8lbs. friction + 4 lbs. effect of gravity = 12lbs., making 12 + 6 + 12 = 30lbs. at the rate of 10lbs. per mile, the same as rising from A to B in one plane, A to B being 3 miles, and B to *b* 14.55 ft., which would be 24lbs. friction, at the rate of 8lbs. per mile; and 6lbs. effect of gravity, at the rate of 2lbs. per mile, making 10lbs. per mile, the same as before; the effect of gravity in aseending one plane being counteracted by descending another; but this is not the case when the inclination of the plane exceeds 19 ft. per mile, the inclination at which a body will descend the plane by its own gravity; because, suppose the planes A C and C B, fig. 1, to be each one mile, and the elevation C *c*, to be 31 ft., then the power necessary to carry one ton of goods from A to B will be as follows:—A to C = 8 lbs. friction, gravity = 16 lbs. = 24 lbs. but the resistance from A to C being only 8lbs. friction, we can only make use of 8 lbs. of the 16 lbs. from the effect of gravity, 8 lbs. of which is consequently lost; so that we see that the compensation for the effect of gravity is lost if the inclination of a plane exceeds 19 feet per mile, when the effect of gravity equals the friction.

On a Railway constructed with variable gradients, the resistance of the load varies according to the angle of

the plane on which it happens to be travelling; and as it follows that the engine must have sufficient power to overcome the greatest resistance, it will become necessary to employ an engine of greater power and weight than on a level road, where assistance is made use of to ascend the planes: it also follows, that the rate of travelling will vary also, because, when an engine of sufficient power to overcome the resistance of the steepest inclined plane, at the rate of 10 miles per hour, is used, it would travel at a very much greater rate than when on a plane of less inclination, say 30 miles per hour, which would be the most rapid rate of travelling; the engines are therefore exposed to considerably more wear and tear than if they were kept going at a regular speed. In addition to which, a locomotive engine is not so well adapted to raise a weight as it is to overcome the friction; because, when an engine ascends an inclined plane the pressure on the plane is diminished, and consequently the adhesive power between the rails and the wheels of the carriage; and if the resistance should surpass the power of adhesion, all locomotion would cease.

Now a Railway constructed upon the principle of a series of level planes, connected by steep inclined planes, has considerable advantages over one of variable gradients. In the first place, the engines act upon much more advantageous principles upon a level than they do on inclined planes, as I have before demonstrated; secondly, there is less loss of time in ascending to the necessary elevation at once, and then running a considerable distance upon a level, because the assistant power may be sufficient to maintain the regular speed, and a lighter engine maintain the same speed on a level. Now it will be seen, that in the first plan we can only obtain an average speed, whereas, on the latter, the engines travel at an uniform speed, and therefore admit of being made so that they will be less subject to wear; hence considerable advantages are possessed by the latter over the former plan.

As it is necessary to employ a more powerful engine on a Railway constructed upon the plan of the variable gradients, so also it requires a stronger rail to carry it; while the rails will wear no longer, in point of traffic, than if the engine were lighter and the rails lighter, as the time they will last is according to the time they will carry the engines, which generally form the greatest load, supported upon the same number of wheels in the train; but where powerful locomotive engines are used to assist on inclined planes the rails require to be made stronger than the other part of the road: that strength is only governed by the weight of the assistant engine, and only requires to be laid on that part where the assistant engine travels.

Under these considerations, I should consider the plan of making a Railway on the latter plan, that is to say, a series of level planes, connected by inclined planes, preferable to that of the variable gradients. In addition to the arguments already stated, it may be mentioned that the speed and tractive power will be nearly equal in both directions.

The examples I have given in this paper are calculated from the latest and best experiments; namely, that it requires the force of 8 lbs. to draw one ton weight upon a level; and that it requires double that power to draw the same weight up a plane rising one foot in 280, or 19 feet in the mile, as I mentioned in my last. E. F. W.

## NATURAL PHENOMENA.

### ON METEORIC STONES.

We are indebted to a translation of a paper, by Professor Berzelius, in the last number of the Philosophical Magazine, for the following interesting particulars:—Meteoric stones, as our readers are no doubt aware, are bodies of a peculiar kind, that occasionally fall upon the earth. The largest we are aware of is in the museum of the East India Company. It fell in India.

The author commences, by considering which of the conjectures respecting the formation of meteoric stones is the most probable. That which refers these bodies to eruptions

of the volcanos of our earth cannot be supported, on account of the distance of the places where they have fallen from any volcano, and also from the different constitution of volcanic products and meteorities; neither can the opinion of their formation from either the common, or even the accidental constituents of the atmosphere be admitted. Anaxagoras imagined that a stone which fell in his time, in Ægos Potamos, came from another world. This, which is probably a correct opinion, is supported by the researches of our own age. Olbers, in a paper on the fall of a meteorite, which occurred at Sienna, in Italy, on the 16th of July, 1794, suggested, in 1795, the possibility of these bodies being projected from the moon; but it appeared to him much more likely that they came from Vesuvius. Laplace likewise adopted this opinion in 1802. That part of the moon which is turned towards us is covered with elevations, and it is found that there are many mountains which precisely resemble in their external appearance those volcanos of our earth which have craters; these mountains are of such magnitude that the interior of their craters may be seen with good telescopes; and it can be readily perceived that one half of the interior is illuminated by the sun, and the other is in the shade, whilst the circular opening of the crater is extremely distinct. It may then be supposed that these mountains owe their form to the same cause as terrestrial volcanos, viz. to eruptions; but if the force which produces lunar eruptions is as considerable as the projectile force of our volcanos, the bodies thrown out ought to be projected much further from the moon than the earth; for, 1st, the mass of the moon is to that of the earth only as 1.45 to 100, and its weight is in the same ratio; 2ndly, the moon has no atmosphere, or, at most, one so highly rarefied, that when the fixed stars are eclipsed by the moon, no refraction of the rays of light can be perceived: consequently the projection occurs *in vacuo*, and without that mechanical resistance to projected bodies which is caused by the atmosphere of the earth, in which they soon become quiescent; 3rdly, if a body is projected towards the earth from the moon the attraction of the earth for it continually increases, whilst that of the moon diminishes more and more; 4thly, the limit of equilibrium between the earth and the moon is much nearer the latter than the former.

Many circumstances connected with the composition of meteoric stones agree with what we know respecting the moon. Some of these bodies contain metallic iron, which, when exposed to air and moisture, is by degrees converted into hydrated peroxide of iron; and this is the case with the minerals of the crust of our globe under such circumstances; therefore, in their primitive situation, they are without atmospheric air, or even possibly without either air or moisture.

Astronomical researches have not as yet discovered in the moon any traces of water large enough to be distinguished by good glasses, and M. Berzelius considers that water has not been met with chemically combined in meteoric stones. The greater number of meteoric stones resemble each other so much in their composition, that they may be considered to come from the same mountain, that is, from the central culminating point of that side of the moon which is always turned towards the earth. A small number only present a different appearance, and it is therefore probable that these proceed from mountains situated on other parts of the moon.

Nevertheless meteoric stones may have their origin in another planet. Olbers considers that the Asteriods between Mars and Jupiter, may be fragments arising from the destruction of a larger planet, an idea which has induced the search for more of these fragments, and the discovery of one of them by Olbers himself. If such a catastrophe has occurred, which seems established by the great angle that the course of Pallas makes with that of the other planets, an immense number of small fragments would be projected in such directions that their course around the sun being diminished, they would then, during their revolution, come within the sphere of attraction of other planets, and fall on them.

If we consider meteoric stones as

mineralogical specimens, and compare them with those of our earth, we shall find essential differences, even putting out of the question the existence of the native iron. The abundance of magnesia which is in all the chief constituent, the poverty in silica, and the small proportion of the silicates of alumina and of the alkalies, distinguish the meteoric minerals. On this earth it is just the contrary: here silica is the predominant substance, and the silicates of alumina and the alkalies form every where its principal constituents. Magnesia is rare.

The fineness of grain and feeble cohesion of meteoric stones would lead one to suppose that they are projected in a fused state, and consequently resemble the products of terrestrial volcanos, yet this does not appear to be the case. If we carefully examine the texture of a large fragment of a meteoric stone, it will be found to be split, and the fissures filled with another kind of mineral, for the most part of a deeper colour, which indicates a slower and calmer formation. If olivine is found amongst the products of terrestrial volcanos, and rarely in other minerals, it is no proof that it must always be a volcanic product. It is infusible, and is found inclosed in volcanic minerals, because it could not be fused with them. On the contrary, in meteoric stones, it is so uniformly mixed with the other constituents that its presence in these is evidently owing to another cause which does not exist in lava and basalt.

## THE DAVY LAMP.

The mines of England have undoubtedly been one of the principal causes that have contributed to obtain for her the lofty pre-eminence she enjoys amongst the other nations of the earth. And, by a concurrence of fortunate circumstances, whenever she has appeared in danger of losing some of the advantages arising from her mines, by natural causes, science has lent its aid to restore what would otherwise have been inevitably lost. For instance, when the miners had carried their operations so deep into the earth, that the difficulty of raising water by pumps was becoming almost insurmountable, the steam-engine was invented, and accomplished all that could be desired. And when the frequent accidents from the explosion of gases made the miner tremble for his safety, the beautiful and ingenious instrument that forms the subject of this article, was produced. In No. VII. will be found an engraving and a description of the Safety Lamp, or, as it is generally termed by the miners, in gratitude to the inventor, "the Davy." To that description we now add the following particulars:

In the month of August 1815, Sir Humphry Davy first turned his attention to the subject, and knowing how desirable it was to find some substitute for the naked candles with which the men had been in the habit of working, he first tried Kunkel's, Canton's, and Baldwin's phosphorus, and likewise the electrical light in close glass vessels, but without success. He then constructed a lamp with two valves, so contrived that the valves closed whenever the lamp was carried into an atmosphere contaminated with fire-damp; but it was found that this lamp could not be used in explosive atmosphere.

By subsequent experiments, he found that the fire-damp is light-carburetted hydrogen, or hydrogen gas holding carbon in solution; that it will not explode unless mixed with a portion of atmospheric air; that it explodes with most vehemence when mixed with seven or eight times its volume of air; that it retains its explosive power when mixed in the proportions of only one of gas to fourteen of air; and that when the atmospheric air is in greater quantity, the light of a taper merely becomes enlarged when brought within it, and that this effect is perceptible in a mixture of even thirty parts of air to one of gas. He found also, that the fire-damp is much less combustible than other inflammable gases; that it is not exploded by red-hot charcoal or red-hot iron, though iron at a white heat will explode it; and that "on mixing one part of carbonic acid with seven parts of an explosive mixture of fire-damp, or one part of azote with six parts, their powers of exploding were destroyed."

In the prosecution of these inquiries he found that it was difficult to explode the mixture of air and fire-damp in small

tubes; and that in tubes of only one-seventh of an inch in diameter, and open to the atmosphere, it could not be inflamed, and especially if the tubes were metallic.

In reasoning upon these various phenomena it occurred to him, as a considerable heat was required for the inflammation of the fire-damp, and as it produced, in burning, comparatively a small degree of heat, that the effect of carbonic acid and azote, and of the surfaces of small tubes in preventing its explosion, depended upon their cooling powers,—upon their lowering the temperature of the exploding mixture so much that it was no longer sufficient for its continuous inflammation.

This idea led to an immediate result:—the possibility of constructing a lamp, in which the cooling powers of the azote and carbonic acid formed by combustion, or the cooling powers of the apertures through which the air entered or made its exit, should prevent the communication of explosion.

"I made," says Sir Humphry Davy, "several attempts to construct safety-lamps which should give light in all explosive mixtures of fire-damp; and after complicated combinations, I at length arrived at one evidently the most simple,—that of surrounding the light entirely by wire gauze, and making the same tissue feed the flame with air and also emit light."

"In plunging a light," continues he, "surrounded by a cylinder of fine wire gauze into an explosive mixture, I saw the whole cylinder become quietly and gradually filled with flame; the upper part of it soon appeared red-hot, yet no explosion was produced."

"It was easy at once to see, that by increasing the cooling surface in the top, or in any other part of the lamp, the heat acquired by it might be diminished to any extent; and I immediately made a number of experiments to perfect this invention, which was evidently the one to be adopted, as it excluded the necessity of using glass or any fusible or brittle substance in the lamp, and not only deprived the fire-damp of its explosive powers, but rendered the inflammable gas itself an useful light."

Omitting the detail of other experiments, it was found that iron wire gauze, composed of wires from one-fortieth to one-sixtieth of an inch in diameter, and containing twenty-eight wires or seven hundred and eighty-four apertures to the inch, was safe under all circumstances; and this material Sir Humphry Davy was therefore induced to adopt for the construction of lamps for coal-mines. We must continue the subject next week.

## INSTITUTIONS.

### LECTURES DURING THE WEEK.

*London Institution*, Finsbury Circus.—Monday evening, Jan. 9, at seven o'clock, Dr. Ritchie, on Voltaic Electricity.—Thursday afternoon, Jan. 12, at one, Mr. Sheridan Knowles, on the Drama.

*London Mechanics' Institution*, Southampton-buildings, Chancery-lane. —Wednesday, Jan. 11, at half-past eight, E. Cowper, Esq., on Engraving by Machinery.—Friday, 13, Dr. Birkbeck, on Osteology.

*Western Literary and Scientific Institution*, 47, Leicester-square.—Thursday, Jan 12, at half-past eight, E. Cowper, on Weaving.

*Society of Arts*, Adelphi.---Tuesday evening, Jan. 10, the Secretary, on the Metallurgical History of Iron.

*Islington Literary and Scientific Society*.---Thursday, Jan. 12, at eight o'clock, Mr. H. Goodby, on Insects; illustrated by the oxygen-hydrogen Microscope.

*Mutual Instruction Society*, Southampton Coffee-House, Chancery-lane.—Thursday, Jan. 12, at half-past eight, a *Conversazione*.

### QUERY.

The best mode of extracting glass stoppers?—F.

### TO CORRESPONDENTS.

"Mr John Gregory's" paper on an improvement in Balloons, in our next.

"A Journeyman Mechanic" shall be answered at length very shortly.

"A Subscriber." We intend to give an article on the subject.

"Mr. Wivell." What would be the probable expense? and where can the machine be viewed?

"Mr. Rough's" paper in a No. or two.

"S. T. C." The article shall be inserted the first opportunity.

"J. L." The "London Magazine," published by Fox, 67, Paternoster Row, will afford him the information required.

All Letters and Books for Review should be addressed "To the Editor," at the Publisher's, post paid.

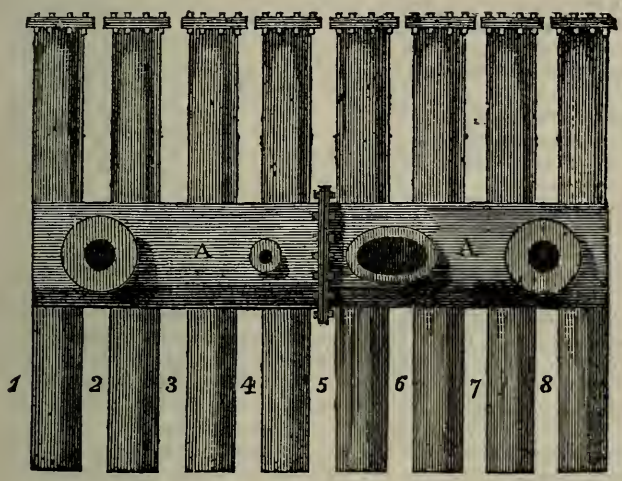
London: Printed at the Holloway Press, by D. A. Doudney; published by Berger, Holywell-street, Strand; and may be had of all Booksellers.

# THE PENNY MECHANIC.

A MAGAZINE OF THE ARTS AND SCIENCES.

No. XI.] JAN. 14, 1837. [Vol. I.

WOOLF'S BOILER.

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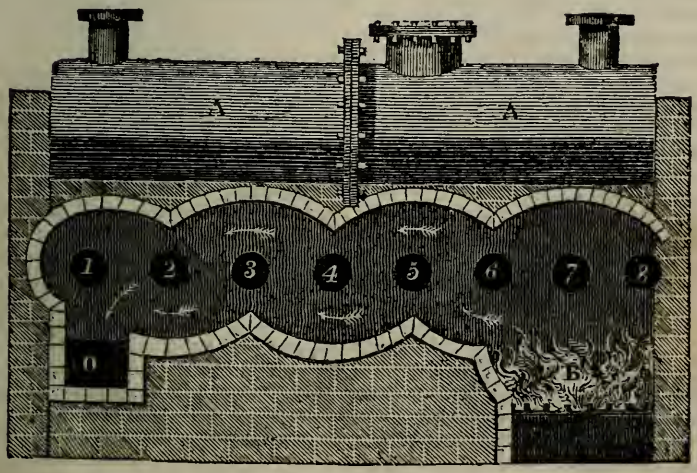




Holloway Press: D. A. Doudney.

## THE STEAM BOILER.

In our front page we present our readers with an engraving of Mr. Woolf's steam boiler, consisting of a series of cast-iron tubes, connected by means of screw bolts with the under side of a large vessel A A, which communicates with the engine.

One of the apertures in the upper, or principal boiler, A A, is intended for the admission of water, to supply the waste arising from evaporation, and the others point out the situation of the man-hole and safety-valves. This boiler possesses the advantage of diminishing the danger to be apprehended from explosion, as a series of gun barrel tubes may be made much stronger with the same quantity of metal, than a boiler of larger capacity. The diagram shows Mr. Woolf's method of setting his boiler as follows:

The principal boiler is still represented at A A, and the figures 1, 2, 3, &c. refer to the corresponding tubes in the previous diagram. B is the fire-place, O the chimney, and the arrows point out the long and waving course of the smoke and flame in their passage to the chimney.

In the Philosophical Transactions, No. 461, there is an account of a new way of producing steam of more than ordinary pressure. The boiler consists of an inverted conical vessel of iron, to the base or upper part of which a close and strong copper head or hemisphere is joined by rivets all round: the lower part, or cone, is set in a reverberatory furnace, to receive a sufficient heat from the flame to make it red hot. The water is introduced into this boiler in a number of small streams, or jets, which are injected into it by a pipe, which descends through the cover, or spherical top, of the boiler; and in the middle of the cone several spouts are fixed, radiating from it like the arms of a wheel: the pipe must be carried above the boiler, so as to have a column of a sufficient height to overcome the pressure of the steam, and also enter into the boiler with a considerable force; and by the radiating spouts it is dispersed into a shower upon the interior surface of the iron cone, and is thus converted into steam, which flies up to the copper head, and is carried off by a pipe to the engine. The inventor proposed to make the tube with the radiating spouts to revolve, for the purpose of distributing the water more completely.

## EFFECTS OF GUNPOWDER, WITH DIFFERENT CHARGES IN A GUN.

If a gun is loaded with ball it will not kick so much as when loaded with small shot; and amongst different kinds of shot, that which is the smallest, causes the greatest recoil against the shoulder. A gun loaded with a quantity of sand, equal in weight to a charge of snipe-shot, kicks still more. If, in loading, a space is left between the wadding and the charge, the gun either recoils violently, or bursts. If the muzzle of a gun has accidentally been stuck into the ground, so as to be stopped up with clay, or even snow, or if it be fired with its muzzle plunged into water, the almost certain result is that it bursts.

The ultimate cause of these apparently inconsistent effects is, that every force requires time to produce its effects; and if the time requisite for the elastic vapour within to force out the sides of the barrel, is less than that in which the condensation of the air near the wadding is conveyed in sufficient force to drive the impediment from the muzzle, then the barrel must burst. It sometimes happens that these two forces are so nearly balanced that the barrel only swells; the obstacle giving way before the gun is actually burst.

The correctness of this explanation will appear by tracing step by step the circumstances which arise on discharging a gun loaded with powder confined by a cylindrical piece of wadding, and having its muzzle filled with clay, or some other substance having a moderate degree of resistance. In this case the first effect of the explosion is to produce an enormous pressure on every thing confining it, and to advance the wadding through a very small space. Here let us consider it as at rest for a moment, and examine its condition. The portion of air in immediate contact with the wadding is condensed; and if the wadding were to remain at rest, the air throughout the tube would soon acquire a uniform density. But this would require a small interval of time; for the condensation next the wadding would travel with the velocity of sound to the other end, from whence, being reflected back, a series of waves would be generated, which, aided by the friction of the tube, would ultimately destroy the motion.

But until the first wave reaches the

impediment at the muzzle, the air can exert no pressure against it Now if the velocity communicated to the wadding is very much greater than that of sound, the condensation of the air immediately in advance of it may be very great before the resistance transmitted to the muzzle is at all considerable; in which case the mutual repulsion of the particles of air so compressed, will offer an absolute barrier to the advance of the wadding.

If this explanation be correct, the additional recoil, when a gun is loaded with small shot or sand, may arise in some measure from the condensation of the air contained between their particles; but chiefly from the velocity communicated by the explosion to those particles of the substances in immediate contact with the powder, being greater than that with which a wave can be transmitted through them. It also affords a reason for the success of a method of blasting rocks by filling the upper part of the hole above the powder with sand, instead of clay rammed hard. That the destruction of the gun barrel does not arise from the property possessed by fluids, and in some measure also by sand and small shot, of pressing equally in all directions, and thus exciting a force against a large portion of the interior surface, seems to be proved by a circumstance mentioned by Le Vailant and other travellers, that, for the purpose of taking birds without injuring their plumage, they filled the barrel of their fowling-pieces with water, instead of loading them with a charge of shot.

## OXYGEN NECESSARY FOR COMBUSTION.

The necessity for the presence of oxygen in the more familiar cases of combustion is so clearly exemplified in a certain operation on cotton goods, called singeing, and has been contrived for the purpose of taking off all the ends of the threads and other downy filaments that are usually attached to the piece, and of giving the whole a smooth surface.

To effect this, several pieces of calico, previously fastened together by their ends, are lapped smoothly round a large wooden roller, from which, by a regular motion, they are passed over a large semi-circular piece of cast iron, which, by means of a furnace placed immediately beneath it, is constantly kept at a full red heat.

Calicoes, muslins, dimities, fustians, &c. are treated in this manner, and the subsequent bleaching takes out any stains which they may have contracted from the iron.

To a stranger, this may seem a very destructive operation (and no one can witness it for the first time without astonishment); but by the quickness and regularity of the motion, and by the uniform pressure of the cloth upon the hot iron, the combustion that would otherwise take place is prevented, and nothing is burnt but the loose threads that rise above the surface of the fabric. The peculiar effect that is here produced, and how the cloth is protected from the red-hot metal, may be thus explained.

The uniform pressure of the cloth upon the heated cylinder, keeps that part of it which is directly over it in close contact, so that there is no space for the intervention of any more atmospheric air than is just sufficient to occasion the combustion of the mere superficial filaments of the cotton or linen: and this is the only effect which the manufacturer is desirous of producing.

## THE HUMAN BODY.

THIRD ARTICLE.

In our last paper, the general material properties of the blood were described. We have now to consider its more important qualities; those which it presents as a vital fluid. The blood in all ages has been regarded as the most important fluid of the body, even before its common properties were known, before its chemical constitution had been ascertained or its circulation discovered, before indeed any thing more was known respecting it, than what an attentive observer, though not an anatomist, may be supposed to be familiar with in the present day, the blood was always considered to be mysteriously connected with animal life.

The popular opinion, respecting the vitality of the blood, was for a long time disregarded by physiologists, who considered this fluid but little more

important than any of the fluids of the body. Dr. Hunter, however, by a series of well-conducted and very interesting experiments, proved that the blood was distinguished from every other fluid by its possessing life. Some of the peculiarities attendant upon this attribute, we are now about to describe.

The blood of our bodies is contained in and circulated through a series of tubes, distributed to every part and varying in diameter from a size quite unappreciable to that of the large artery which has its commencement in the heart itself. Now it is obvious that if some of these vessels were divided by a sharp instrument, so that the blood was allowed to escape from them, it would soon all flow from the body, even on the slightest wound, unless nature provided a means by which the hæmorrhage or flow of blood could be stopped. This is effectually accomplished by the blood itself. No sooner does it quit the vein or artery, in which it has been circulating, than it undergoes an imperfect change; it coagulates, it thickens, and thus clogs up the end of the vessels from which it may be issuing, so that any further loss is entirely prevented. Every one must have observed this when they have accidentally made an incision into the skin: in the larger arteries of the body, however, hæmorrhage is not stopped by this means, because the force of the current of blood sent from the heart prevents the adhesion of the cut end of the artery.

It has been found by numerous experiments, that nothing can prevent the blood coagulating when once it quits the living vessel in which it has been circulating. To explain the change which takes place, we will suppose a basonful of blood has been allowed to flow from a person's arm, as in the ordinary operation of bleeding. If this blood be attentively watched, at the expiration of about ten minutes it will be found to have changed from a red, glutinous, homogenious fluid into a solid and a fluid,—a clot of a red colour floating in a fluid, which, after a short time, will be nearly white. This effect is produced under all circumstances. If the blood be frozen immediately it is taken from the body, it will be found coagulated when it is thawed. If it is heated to a temperature much above that which it maintains in the body, the same effect takes place. If it be kept at rest, or in violent action, still it coagulates. Indeed, the best way to obtain a good clot for examination, is to keep the blood in action with a piece of besom as it flows from the animal.

In order to ascertain whether coagulation could not be prevented if an artificial circulation was kept up,—the blood being maintained at its ordinary temperature, 98°—it has been made to circulate, under these circumstances, through blood-vessels taken from the body of a dead animal—still the blood coagulated. The cause of this surprising phenomenon can only be explained, with any degree of satisfaction, by the theory which supposes that the blood is alive; that it has a natural tendency to coagulate, but that this change is prevented by its possessing life; and that consequently, as soon as the blood is removed from the body, or its circulation impeded, so that its vitality is destroyed, it can no longer resist the tendency to coagulate, which effect is consequently produced. That the blood is alive while within the body, and possesses different properties to the other fluids, such as saliva, or dymph, may be proved, we think, satisfactorily, from a variety of sources. It has the power of resisting, within certain limits, the influence of the ordinary laws which govern matter:—for instance, Hunter found that it could resist the effect of cold for a certain time, the same as an egg, containing the living principle, can. He found that after the blood had once been frozen it could be frozen a second time, at a less degree of cold than the first time; and a third time with a less degree of cold than the second; thereby showing that the vital principle had been affected by the previous process. Hunter also proved that it must itself be alive, because it would unite living parts, which dead matter could not do. When a bone is broken, the blood effused between the broken ends soon has a number of blood-vessels sent into it, which deposit fresh bone, and remedy the injury that has taken place. Hunter says very posi-

tively, that vessels actually originate from within the clot itself. From these facts it is concluded that the blood must possess life, or living vessels would not be sent into it. He also performed a variety of experiments on fowls, such as removing a living portion from one and sewing it up in the abdomen of another, when the part adhered and became a part of the latter. These experiments also showed that the blood must possess vitality, and in a future paper we will describe the effects that are produced when it dies.

## PRESSURE OF THE ATMOSPHERE.

*To the Editor of the Penny Mechanic.*

SIR,—On the surface of our earth there exists an invisible elastic fluid, commonly denominated the atmosphere, or air, without which it would be utterly impossible for animal life to be sustained. It has been calculated to extend to a distance of about forty-five miles from the surface of the earth, its density being different at different altitudes, it becomes more rarified as its distance from the earth increases. It is a material substance, therefore must possess a weight, which acts with a certain degree of pressure on all bodies exposed to it, whether solid or fluid; and which pressure is estimated to be equal to about fifteen pounds on every square inch of surface; that is, a column of air, forty-five miles high and one inch square, will weigh 15 lbs.

Many people imagine that the air is void of any pressure because they have no sensation of it; but the reason of this is very clear, for the pressure of the air, with respect to our bodies, acting both externally and internally, the pressure is counterpoised, which renders it insensible. But the pressure of the atmosphere is manifest in many instances. Close a pair of bellows, so as to force the air out of them, then stop the nozle and valve-hole, and it will be found that to separate their sides, a force of some hundreds of pounds will be required, which is owing to the external pressure of the atmosphere. Fill a glass tube, which is about thirty-four inches in length, and closed at one end, the bore of the tube being sufficiently large to prevent any sensible effect by "capillary attraction," with mercury; insert it into a small vessel containing some of the same fluid, and the mercury in the tube will descend from the upper part of the tube and remain suspended at an altitude of between twenty-eight and thirty-one inches from the surface of the mercury contained in the vessel, it being supported by the pressure of the air on the external opening of the hole, the various altitudes of the mercury indicate the amount of the pressure. This simple instrument is called a "barometer," by which the elasticity or pressure of the air is estimated. Now if the air possessed no weight, how is it possible for the mercury in the tube to be supported? for by putting the barometer under the receiver of an air-pump, and exhausting the air out of the receiver, the mercury in the tube will fall till it is level with that in the vessel, the pressure of the air no longer acting on it. It was partly by the pressure of the air that Newcomen's steam-engine, which is more generally known by the name of the "atmospheric engine," was made to work, the cylinder of the engine being open at the top, so that the upper surface of the piston was exposed to the pressure of the air, which, as soon as the steam below the piston was condensed, by means of a jet of cold water, forced the piston down.

S. T. C.

## SHIPWRECKS.

*To the Editor of the Penny Mechanic.*

SIR,—In all sea-going vessels, when expense in the outfit is not of materia consideration, the provision, cargoes, and lives of crews and passengers can be saved, from ships that are water-logged, and safely brought into port, even if the vessel be consigned to the remotest part of the globe.

The limits of your paper will not allow me fully to explain the various plans that can be acted on by all the commercial nations in the world, for carrying the above plans into execution, in every craft, from the Thames wherry to the British 120-gun ship; but, so far as I know, no one, except myself, has ever yet thought of the perpendicular stowage of vessels. But it is by this peculiar stowage that the above

plans can and will be carried into execution.

1st. Let us imagine that in a seventy-four-gun ship there is one or many iron cylinders, or oblong wooden cases, rising perpendicularly from the keel, through all the decks, to from four to six feet above the upper deck; that the carlines and beams of the ship are placed at such distances, that these cylinders, or cases, can be bolted to them; and that the projection outside the cylinders, or cases, at the bottom of them, can be bolted to the keel and bottom of the vessel; and that the sides of these cases are sufficiently strong to prevent them from being broken or dinged by the usual accidents that might happen on board.

2nd. Let cases be made, water-proof and strong as a beer-but, to fit, without loss of room, in these perpendicular cases. Let the internal cases be made of cast metal, or sheet iron, or wood; and let there be at least one inch clear between all parts of the inside of the outer case and the outside of the inner case. Let there be eye-bolts at the corners, or sides of the internal cases; and let five fathoms of half or three-quarter-inch, be spliced into each eye-bolt: then lower away the first case, which we will suppose to be five-sixths, or seven-eighths full of water (for every case must be a little less weight than an equal bulk of sea-water). Splice the four ends of the ropes to the eye-bolts in the next case, and lower away. Continue this until your cylinder, or perpendicular cases, are all full of provisions; then, in case the vessel fills, and should the ship go down, provided that these cases are clear of the ship's rigging, the uppermost case of provisions will first float, the next to it in succession, until the whole rise, and come within reach of the crew. But if the ship does not go down, and if the water, provisions, &c. are in one case, in different parts of it, in daily allowances for the crew, they can get at these things much easier than they now can in any ship, because there will be no stowing and re-stowing required.

I am your obedient servant,

M. Rough.

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## PHOSPHORESCENCE OF THE SEA.

*To the Editor of the Penny Mechanic.*

Sir,—In No. VIII. of your Magazine is an account of the luminous appearance of the sea, and its probable cause. I beg to offer you the following extract from the "Companion to the Almanac," of 1830.

"Captain Horne, R. N., in a paper addressed to the 'Quarterly Journal of Science,' communicates the discovery that the cause of the brilliant light observed in the *sea-weed* thrown on the beach of Laucing, on the coast of Sussex, is the animalculæ (satularia volubills) of Elis, described by him in his 'Caralliines and Zoophytes (the clytia volubilis) of Lamouroux,' but not mentioned to be luminous.

"On the 8th of December, and the following days, a great quantity of weed had been thrown up by a hard-blowing south-west wind, so that the beach was covered with it to more than two feet deep in many places. After dark a small quantity was collected of the most brilliant, and this was always found to be that which had been left at the first of the ebb, and was only moist rather than that which had been just washed up. Picking out a single spark, and removing from it every extraneous matter, Capt. Horne ascertained, by the aid of a microscope, that the light was caused by the insects adhering to the sea-weed. The light would remain sometimes steady for about five seconds, often less, and when it ceased was renewed by touching it with the finger. In a darkened room, by day, no light whatever was emitted, yet the same weed, kept till the evening, was as brilliant as any that had been found." I am, yours truly,

J. L.

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## ECONOMIZING LABOUR.

The fatigue produced on the muscles of the human frame does not altogether depend on the actual force employed in each effort, but partly on the frequency with which it is exerted. The exertion necessary to accomplish every operation consists of two parts: one of these is the expenditure of force which is necessary to drive the tool or instrument; and the other is the effort required for the motion of some limb of the animal producing

the action. In driving a nail into a piece of wood, one of these is lifting the hammer, and propelling its head against the nail; the other is, raising the arm itself, and moving it in order to use the hammer. If the weight of the hammer is considerable, the former part will cause the greatest portion of the exertion. If the hammer is light, the exertion of raising the arm will produce the greatest part of the fatigue. It does therefore happen, that operation requiring very trifling force, if frequently repeated, will tire more effectually than more laborious work. There is also a degree of rapidity beyond which the action of the muscles cannot be pressed. The most advantageous load for a porter who carries wood up stairs on his shoulders has been investigated by M. Coulomb; but he found from experiment that a man walking up stairs without any load, and raising his burden by means of his own weight in descending, could do as much work in one day, as four men employed in the ordinary way with the most favourable load. The proportion between the velocity with which men or animals move, and the weights they carry, is a matter of considerable importance, particularly in military affairs. It is also of great importance for the economy of labour, to adjust the weight of that part of the animal's body which is moved, the weight of the tool it urges, and the frequency of repetition of these efforts, so as to produce the greatest effect. An instance of the saving of time by making the same motion of the arm execute two operations instead of one, occurs in the simple art of making the tags of bootlaces: these tags are formed out of very thin, tinned, sheet-iron, and were formerly cut out of long strips of that material into pieces of such a breadth that when bent round they just enclosed the lace. Two pieces of steel have recently been fixed to the side of the shears, by which each piece of tinned-iron as soon as it is cut is bent into a semi-cylindrical form. The additional power required for this operation is almost imperceptible; and it is executed by the same motion of the arm which produces the cut. The work is usually performed by women and children; and with the improved tool more than three times the quantity of tags is produced in a given time.

## WINDOW GLASS.

The effect of great velocity in modifying the form of a cohesive substance is beautifully shown in the process for making window-glass, termed "flashing," which is one of the most striking operations in our domestic arts. A workman having dipped his iron tube into the glass pot, and loaded it with several pounds of the melted metal, blows out a large globe, which is connected with his rod by a short thick hollow neck. Another workman now fixes to the globe immediately opposite to its neck, an iron rod, the extremity of which has been dipped in the melted glass; and when this is firmly attached, a few drops of water separate the neck of the globe from the iron tube. The rod with the globe attached to it is now held at the mouth of a glowing furnace: and by turning the rod the globe is made to revolve slowly, so as to be uniformly exposed to the heat: the first effect of this softening is to make the glass contract upon itself and to enlarge the opening of the neck. As the softening proceeds, the globe is turned more quickly on its axis, and when very soft and almost incandescent, it is removed from the fire, and the velocity of rotation being still continually increased, the opening enlarges from the effect of the centrifugal force, at first gradually, until at last the mouth suddenly expands or flashes out into one large circular sheet of red-hot glass. The neck of the original globe, which is to become the outer part of the sheet, is left thick to admit of this expansion, and forms the edge of the circular plate of glass, which is called a "Table." The centre presents the appearance of a thick boss or prominence, called the "Bull's-eye," at the part by which it was attached to the iron rod.

## AEROSTATION.

*To the Editor of the Mechanic.*

Sir,—As the science of aerostation has of late, but more particularly during the last summer, excited very generally the interest of the public, perhaps the following may not prove altogether uninteresting to your readers. Having for some months past devoted considerable attention to the science, and observing the many insurmountable difficulties attending the bal-

loon now in use, I have been led to invent apparatus to obviate these difficulties; and it gives me great pleasure to inform you, that I have been perfectly successful, having no doubt in my own mind—and many gentlemen are of my opinion—that my apparatus will entirely supersede the use of gas for inflating the balloon. I now flatter myself I have fulfilled Dr. Darwin's prophecy:

> Soon shall thine arm, unconquer'd Steam,
> Drag the slow barge and urge the rapid car,
> Or on wide waiving wings expanded bear
> The flying chariot through the fields of air.

The following difficulties attending the gas balloon are allowed to exist, by every person who has at all entered into the study of aerostation:—

1st, The aeronaut is made to ascend by discharging ballast, and descend by allowing gas to escape, thereby doing away with the ascending power.

2ndly, By the heat of the sun and the diminished density of the atmosphere—though the first acts but slightly in comparison to the latter, for the farther you get from the earth the more you lose the sun's heat, but then you have to contend with the more powerful opponent, the rarified air—by which means the gas is made to expand, thereby endangering the bursting of the balloon, and also doing away with the possibility of entirely inflating it. The only resource to obviate this disadvantage is by allowing gas to escape; this, however, counteracts the ascending power again, which is another insurmountable difficulty, which would render it impossible to continue in the air for any length of time, with sufficient supporting power to insure a steady descent; for the expanded gas would condense upon near approach to the earth, though the heat of the sun attracted by the earth would act in favour of the aeronaut.

3rdly, In crossing any body of salt water by the operation of it on the air decreasing its density, thereby requiring by far more supporting power, which Messrs. Blanchard and Jefferies would have been very glad to have availed themselves of when they crossed the channel in 1785.

4thly, The expense of inflating a balloon with even coal-gas, for a balloon containing 24,000 cubic feet, will cost 25*l.* for inflating. I will now proceed to point out the advantages an apparatus upon my construction will possess over gas.

1st, I can ascend and descend as often as I please without loss of power, thereby enabling me to take advantage of different currents of air which exist at different altitudes; with this control over the machine, it can be rendered by far more manageable than with gas.

2ndly, The heat of the sun will be an advantage rather than otherwise.

3rdly, In crossing a body of salt water, I should require more ascending power.

4thly, The expense of inflating a balloon with gas I said would be about 25*l.* but to render an apparatus upon my construction buoyant would not amount to 5*l.* I have only now to add that my circumstances at present will not allow of the capital required to get up an apparatus for me to make a practicable ascent, to prove the superiority of my invention over the gas balloon; for I would ascend and remain in the air for a week with the greatest confidence. In conclusion, I think, in thus making public my invention, through the medium of your Magazine, it may meet the view of some of your readers, who might be disposed, upon a proper arrangement between ourselves, to find the necessary capital to give it a practicable trial on a larger scale.

Your's obediently,
JOHN GREGORY.

No. 11, *Regent-st., City-road.*

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### LECTURES DURING THE WEEK.

*London Institution*, Finsbury Circus.—Monday evening, Jan. 19, at seven o'clock, Dr. Ritchie, on Voltaic Electricity.—Thursday afternoon, Jan. 19, at one, Mr. Sheridan Knowles, on the Drama.

*London Mechanics' Institution*, Southampton-buildings, Chancery-lane. — Wednesday, Jan. 11, at half-past eight, E. Cowper, Esq., on Engraving by Machinery.—Friday, 13, Dr. Birkbeck, on Osteology.

*Western Literary and Scientific Institution*, 47, Leicester-square.—Thursday, Jan 12, at half-past eight, E. Cowper, on Calico Printing.

*Istington Literary and Scientific Society*.---Thursday, Jan. 19, at eight o'clock, Mr. H. Goadby, on Insects; illustrated by the oxygen-hydrogen Microscope.

*Mutual Instruction Society*, Southampton Coffee-House, Chancery-lane.—Thursday, Jan. 19, at half-past eight, a *Conversazione.*

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### TO CORRESPONDENTS.

"Mr. Patterson." We are much obliged for the Communication. An Engraving shall be made from the model sent us, and inserted in a Number or two.

"J. R.'s" description is hardly explanatory enough. It appears to us, that in order to have the spokes within the cylinder air-tight; there must be considerable friction, *much* greater than that of a piston of an engine. This is an objection; but the plan, on the whole, certainly evinces much ingenuity; and if we can find a place for the paper shortly we will do so.

"National Baths," received with thanks.

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# THE PENNY MECHANIC.

A MAGAZINE OF THE ARTS AND SCIENCES.

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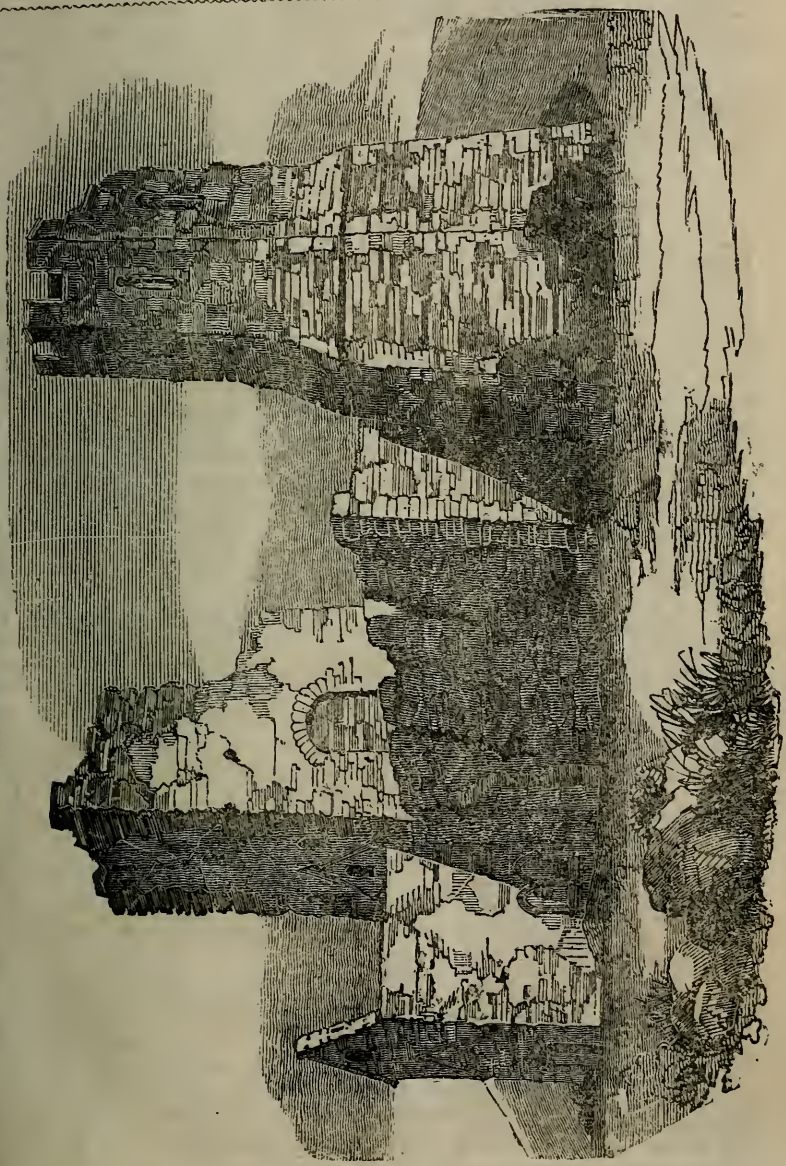


ANCIENT WATCH-TOWERS AT DOVER.



Holloway Press. D. A. Doudney.

## THE WATCH TOWERS OF DOVER.

Dover Castle which commands the town, is one of the most important fortresses in this part of our island. It is near the mouth of the Thames, and is an edifice of considerable antiquity. It was erected on the site of a British hill fortress.

It consists of an immense congeries of almost every kind of fortification by which the art of war has contrived to render a situation impregnable; though its consequence has been materially lessened since the invention and use of cannon; the eminences to the north-west by west, and south-west, being much higher than the site, even of the keep itself. The buildings are so numerous and complex, that a precise idea of their relative situations can hardly be obtained without the assistance of a ground plan. They occupy nearly the whole summit of the high eminence which bounds the south-eastern side of the deep valley in which Dover is built.

In a general way, this castle may be described as consisting of two courts, a lower one and an upper one, from which communications from the inner towers have been made by well-like subterraneous passages. The lower court is surrounded by an irregular wall, excepting on the side next the sea, where a considerable part of the cliff, with the remainder of the wall, was thrown down by an earthquake which happened on the 6th of April, 1680. This wall is called the curtain, and is flanked, at unequal distances, by a variety of towers of different shapes; the oldest of them, which is on the eastern side of the castle, is said to have been built by Earl Goodwin, and it still bears his name; though this, as well as most of the others, have been much altered since their original erection. Nine of the other towers are stated to have been built in the Norman times, and to have taken their name from Sir John de Fiennes, and the warriors whom he had selected to assist in the defence of this fortress.

Averanche's or Maunsel's Tower is a fine specimen of Norman workmanship, standing at an angle formed in this part by the curtain wall. Maunsel, who succeeded Averanche in the command of this castle, was Lord Warden of the Cinque Ports, in the reign of Henry VIII. The next is Veville or Vincester Tower, so called from its different commanders of those names. Further on is Ashfordian Tower, so named from lands near Ashford, which had been granted to keep it in repair; and beyond this, reaching towards the extremity of the wall near the cliff, are three other towers, two of which we give our readers a representation of, from a drawing taken on the spot. They are built with red Roman tiles, and are a striking piece of ancient architecture.

The upper court, like the lower one, is surrounded by a strong wall and several towers; and near the centre stands the spacious keep, erected in the reign of Henry III. The noble tower, called the Keep or Palace Tower, is constructed on a similar plan to those built by Bishop Gundulph, and is much like that at Rochester.

The present entrance is on the south, but its original entrance was on the east side, and it opened by a magnificent portal, now bricked up, into the grand apartments, which were on the third story. The ascent to this portal was by a noble flight of stone steps, commencing on the south side, and continued within a lesser adjoining tower, which flanks the south-east angle and whole east side. The staircase, besides other defences, was guarded by three strong gates, at different heights, and had two vestibules. In the thickest part of the walls, which measures from eighteen to twenty feet, run the galleries; these are so ingeniously contrived, as to render it nearly impossible for the arrows, or missive weapons of an enemy, to do any execution within them. The same cautious policy is observable in the construction of the windows, or rather loop-holes, which preserve their original form, where the arches are so contrived, that no arrow, having the least elevation, could be shot into the apertures, without striking against the wall; many of the original openings have been enlarged in later times. From the turret are seen the point of the North Foreland beyond the light-house, Ramsgate, Sandwich, and Dungeness light-house.

## LAW OF PATENTS.

We have been requested by several correspondents, at various times, to afford them some information regarding the law of patents, we now therefore take the opportunity of doing so.

The following requisite qualities of an invention, in order that it may become the subject of a patent, are stated by Holroyd, in his treatise "on the Law of Patents for Invention."

The invention for which a patent may be granted, must be a manufacture.

The manufacture must be—1st. New, as to its public use and exercise in England—2nd. It must be useful to the public.

A foreign invention, though practised abroad, may be the subject of a patent.

A manufacture discovered by a person, if not made known, will not prevent another person who discovers the same thing, from obtaining a patent for it.

A manufacture is not considered new if it be in use or known to the public at the time of granting a patent for it. As when taken from a book published in England.

If an invention consist of an improvement upon any thing, and that which constitutes the improvement be known, and has been before applied to a similar purpose, though not to the specific thing which the patentee has applied it to, it will not possess sufficient novelty to be the subject of a patent.

Manufactures according to the construction given to the Stat. 21. James I. chap. 3, may be divided into

1st. Things made.

2nd. Practice of making.

1st. *Of things Made.*—I. A thing made which is useful for its own sake, and vendible as such, or some part of such thing.—As, a medicine—telescope—watch, or a movement to a watch, &c.

II. A piece of mechanism, engine, or instrument for producing either old or new effects, by being employed to effect some useful purpose: or a new part of a machine, &c., whereby it is rendered more efficacious.—As a lace machine—steam engine or an improvement on machines.

2nd. *Practice of Making.*—Or principles carried into practice in a new manner; or new results of principles.

I. A mode of employing practically art and skill, producing an effect useful to the public, or an improvement on such modes—or an artificial manner of operating with the hand or with instruments in common use.—Hartley's patent for securing buildings from fire might come under this head; it was a new method of disposing iron plates in buildings.

II. A process or combination of processes in any art producing an effect useful to the public—or an improvement in a combination, &c.—As any chemical process—or an alteration of any known process by an addition of ingredients, &c.

*Of the Person to whom, and for what time a Patent may be granted.*

A Patent may be granted to a person for a discovery communicated to him by another if not previously made public.—As in Dolland's patent for making object glasses; Dr. Hall had given the necessary information to Dolland. So with information gained abroad, if not previously known in England.

The time for which a patent may be granted is limited by Sec. 6, of 21 James I. cap. 3, to fourteen years or under, and the duration of the term can only be extended by act of parliament.

As the business of preparing the specification, and obtaining the patent, is almost always performed by an attorney, we do not think it necessary to describe the manner of accomplishing this. The time engaged in passing the patent is generally about two months; and it may be proper to mention, that a patentee who wishes to secure to himself the benefit arising from the use of his invention in Scotland, or Ireland, must take out separate patents for those countries, besides the English patent.

The following abstract of the Act 5 and 6 Will. IV. c. 83, relating to letters patent, contains some important information to inventors.

Sect. 1, Recites that it is expedient to make certain additions to and alterations in the present law touching letters patent for inventions, as well for the better protecting of patentees in their rights, as for the more ample benefit of the public: enacts that any person having obtained letters patent for any invention may enter with the clerk of the patents of England, Scotland, or Ireland, respectively, as the case may be, having first

obtained the leave of his Majesty's attorney-general or solicitor-general in case of an English patent, of the lord advocate or solicitor-general of Scotland in the case of a Scotch patent, or of his Majesty's attorney-general or solicitor-general for Ireland in the case of an Irish patent, certified by his fiat and signature, a disclaimer of any part of his specification, or a memorandum of any alteration therein, not being such as shall extend the exclusive right granted by the said letters patent; and which, when filed, shall be deemed part of such specification; but a caveat may be entered as heretofore; and such disclaimer shall not affect actions pending at the time; and the attorney-general may require the party to advertise his disclaimer.

2. Where a patentee is proved not to be the real inventor, though he believed himself to be so, he may petition his Majesty in council to confirm his letters patent or grant new ones; and the said petition shall be heard before the judicial committee of the privy council, who, on being satisfied that such patentee believed himself to be the first and original inventor, and that such invention had not been generally used before the date of such first letters patent, may report their opinion that the prayer of such petition ought to be complied with, whereupon his Majesty may, if he think fit, grant such prayer; but any person opposing such petition shall be entitled to be heard before the said judicial committee: and any person, party to any former suit touching such first letters patent, shall have notice of such petition.

3. If in any action or suit a verdict or decree shall pass for the patentee, the judge may grant a certificate, which being given in evidence in any other suit shall entitle the patentee, upon a verdict in his favour, to receive treble costs.

4. Allows a patentee, on advertising as therein mentioned, to apply to the privy council for a prolonged term. If the judicial committee report in his favour, his term may be prolonged for seven years; but such application must be made before the expiration of the original term.

5. In case of action, &c., notice of objections to be given with the pleadings.

6. Costs in actions for infringing letters patent, to be given as either party has succeeded or failed in any part of his case, without regard to the general result of the trial.

7. Penalty for using, unauthorized, the name or device of a patentee, &c. 50l. one half to his Majesty and the other to any informer.

["A journeyman mechanic" who wrote to us a short time since, to know "how he might prevent capitalists who should make offers to assist him, and having by that means obtained a sight of his invention, endeavour to deprive him of the benefit of it," will see by the foregoing that even if the attempt were made it could not be successful, as the patentee must swear that, to the best of his knowledge, he is the first and true inventor, or that the invention has been communicated to him by a foreigner. "A journeyman mechanic," may therefore, we think, without fear, endeavour to obtain the assistance of those who are willing to support him in his application for a patent.]

## OIL GAS.

The gas employed to illuminate the streets of the metropolis, and the various buildings and shops that use it, is produced from coals; but a very brilliant light, superior in many respects to that from the combustion of this gas, may be procured from oil gas. It possesses many advantages over the gas generally used. It is said that it can be prepared from oils which could not be used in lamps; it does not contain sulphurated hydrogen or other matter by which it is contaminated, and there are no objections to its use in close rooms, as it has no suffocating smell. It does no sort of injury to furniture, pictures, &c., and the costly and offensive operation of purifying the gas by lime is totally avoided when it is obtained from oil. Nothing is contained in oil gas which can injure the metal of which the conveyance pipes are made. The oil gas contains no unmixed hydrogen, which occasions the great heat of coal gas, for there is no greater heat in proportion from the flame of oil gas, than from burning oil in lamps. The apparatus for the production of this gas is also very much less expensive than that required for coal gas, besides being much more simple, as we shall directly explain.

The reason oil gas is not generally used is, we presume, because it is thought that if a great quantity was required to be made, the price of oil would so much increase, that the process could not be carried on so economically as it can be from using coals. As, however, the gas can be very easily made in private houses, and as some of our correspondents have requested a little information on the subject, we give the following particulars.

Messrs. J. and P. Taylor were the first persons who resorted to oil as a substance from which gas for illumination could be cheaply and easily prepared, and the apparatus they employed for the purpose was extremely simple. The retort was formed of a bent cast-iron tube, which was heated by a small convenient furnace, and oil was allowed to drop slowly into the tube, from a vessel above it. The oil was immediately volatilized, and the vapour in traversing the tube became perfectly decomposed. A mixture of inflammable gases, which contain a great portion of olefiant gas, passes off; the gas was washed by being passed through a vessel of water which dissolves a little sebacic acid, and seldom required changing, and it was then conducted into the gasometer. The washer and gasometer of Messrs. Taylor are particularly deserving notice. In the washer, two planes are fixed in a box or cistern, in a direction not quite horizontal, but inclined a little in opposite directions; the planes are traversed nearly across by slips of wood or metal, fixed in an inclined position on the under surface, and which alternately touch one side of the cistern, leaving the other open and free. These planes being immersed in water, the gas is thrown in under the lower ridge, and by its ascending power is made to traverse backward and forward along the ridges fixed on the planes until it escapes at the highest part of the uppermost ridge. Thus with a pressure of six inches of water only, it is made to pass through a distance of fourteen or sixteen feet under the surface of the fluid, and become well washed. The smaller gasometers are made of thin plate iron, and being fixed in a frame of iron work, look more like ornamental stoves than the bulky appendages to gas apparatus, which they supply. The larger ones are made very light, and when in pieces, very portable, by being constructed of a frame of wood work, in the edges of which are deep narrow grooves; plates of iron fit into these grooves, which being caulked in and painted over, make a tight and light apparatus. These are easily put together in any place, and may therefore be introduced into a small apartment or other confined space where a gasometer already made up would not enter.

From the above description those who wish to manufacture oil gas for their own use, will probably understand something of the method of doing so. It is only necessary to have an iron tube bent at one end, or of a semicircular form, kept at a red heat; oil must then be allowed to drop into the tube from a vessel placed above it, (the quantity can of course be regulated by a stop-cock) and the oil will be decomposed in the tube, and pass out at the other end as gas. This must be allowed to circulate through water if it is wished to have the gas in a state of purity; but if this is not important, it is merely necessary to have a receiver in order to have a regular supply of gas to the burner. The light procured from gas obtained in this manner will be found far superior to that given out by lamps, and the quantity of oil consumed will be considerably less. One gallon of common whale oil will produce about ninety cubic feet of gas, and an argand burner will require a cubic foot and a half per hour to maintain a perfect light; consequently, a gallon of oil, made into gas, will afford such a light for sixty hours, and the expense, at a moderate price of oil, will be, allowing for coals, labour, &c., not more for one burner than three farthings per hour. Such a burner will also be equal in intensity of light to two Argand oil lamps, or to ten mould candles. One cubic foot of oil gas, will also go as far as four of coal gas, in consequence of its containing a greater quantity of olifiant gas, the gas from which artificial light, whether of candles, oil, or gas, is produced.

As our readers, if they manufacture any of this gas, will probably only make a small quantity, we do not anticipate that they will experience difficulty from the disarrangement of any part of the

simple apparatus. Messrs. Taylor found, however, that after a certain time the tube would not decompose the oil so perfectly as it did at first, and they discovered that a few pieces of broken bricks introduced into the retort or tube greatly increased its decomposing power, from presenting a greater surface for the fire to act upon. In a small tube we dare say that an occasional cleaning to remove the carbon that accumulates will be quite sufficient.

## OBJECTS OF CHEMISTRY.

Chemistry is the science which makes known to us the properties of the component particles of all natural bodies. We speak not only of those compound particles which are the result of organization, but of the ultimate, indivisible, or elementary particles. It treats of the infinitely various sorts of substances, and of the exact determination of their differences. It exhibits the means by which the component parts of compound bodies can be separated from one another, or by which the elements of compounds can be made to combine together. In fine, it shows by what contrivances the corpuscles which constitute the world, can be most beneficially applied to the service of man.

The objects of chemistry are inexhaustible. It undertakes the examination of all substances which act upon the senses. It seeks to determine the properties of those substances, the number and proportion of their component particles, the individual nature of those components, and the properties of all other compounds which can be produced by their combination, either in different numbers or in different proportions. There are no bounds to the researches of chemistry; because, at whatever point its operations commence, there is no telling to what they may lead. Indeed, so infinitely varied are its objects, that it is an everlasting source of occupation and amusement; and while, on this account, it receives the attention of the curious philosopher, it claims the notice of all men, from its utility in the arts by which the comforts and existence of civilized life are promoted and supported.

The great mportance of the science of Chemistry is rendered evident by the following considerations.—It is useful in explaining natural phenomena; and in acquiring a knowledge of the constitution of the atmosphere, in investigating the changes to which it is subject, the variations of temperature, the laws of winds, dew, rain, hail, and snow, Chemistry is our principal, our only satisfactory guide. These remarkable changes in the face of nature—changes which, because familiar, do not produce any emotion in the mind, though in themselves truly wonderful—are chemical operations on a magnificent scale, and can only be explained by chemical laws.

In man's researches into the nature of the things whence he derives the means of his comfort, his happiness, his luxuries, and even his existence—in examining the various objects which compose the mineral, the vegetable, and the animal kingdoms, Chemistry is essentially requisite for the successful progress of his inquiries.

In considering the application of Chemistry to the improvement of the arts of civilized life, a wide field of contemplation opens to our view. So extensive, indeed, are its influence and importance, that, in most of the arts, many of the processes—in some all that are employed—depend on chemical principles. The bare mention of some of these arts will suggest ample illustrations of its extensive utility.

In the medical art, of so great service is a knowledge of Chemistry, that it is now universally regarded as an essential branch of a medical education. In the art of extracting metals from their ores, in purifying and combining them with each other, and in forming instruments and metals—whether for useful or ornamental purposes—almost all the processes are purely chemical. The arts of glass and porcelain making, of tanning, soapmaking, dyeing, and bleaching, depend entirely upon chemistry; and in all the processes in baking, brewing, and distilling, most of the culinary arts, and many other processes in domestic economy, are chemical operations. In short, wherever, in any of the processes of nature or of art, the accumulation or the diminution of heat takes place—wherever substances in

combination are to be separated—wherever the union of simple substances and the formation of new compounds are effected;—the operations and their results can only be explained on chemical principles.

From the general view of the extensive application of chemical science, those who have not considered the objects which it embraces will be enabled to judge of the importance of this study.

If we consider Chemistry purely as a science, we shall find no study better calculated to encourage the generous love of truth which confers dignity and superiority on those who successfully pursue it. There is no science which holds out more interesting subjects of research, and none which affords more striking proofs of the wisdom and beneficence of the Creator of the universe. A machine constructed by human art, is admired in proportion to the simplicity of its contrivance, to the extent of its usefulness, and to the niceness of its adaptations. But the works of man sink into nothing when brought into comparison with the works of nature. When we examine the former, every step of our progress is obscured with comparative clumsiness and defect: in contemplating the latter, we behold perfection rise on perfection, and more exquisite wonders still meeting our view. It is the merit of Chemistry, that by its aid we are enabled to take a minuter survey of the great system of the universe. And we find, so far as our limited powers can comprehend it, that the whole is nicely balanced and adjusted, and that all its changes tend to the most beneficial purposes. Circumstances which, on a superficial view, were seeming imperfections and defects, a closer inspection points out to be real excellencies. In all the singular and surprising changes which everywhere present themselves, the more closely we observe and examine them, the more we admire the simple means by which they are accomplished, and the intelligent design and perfect wisdom displayed in the beneficial ends to which they are directed.

Chemistry is a science that is founded entirely upon experiment; and no person can understand it unless he performs such experiments as verify its fundamental truths. The hearing of lectures, and the reading of books, will never benefit him who attends to nothing else: for Chemistry can only be studied to advantage practically. One experiment, well-conducted, and carefully observed by the student, from first to last, will afford more knowledge than the mere perusal of a whole volume. It may be added to this, that chemical operations are, in general, the most interesting that can possibly be devised.—*Griffin.*

## THE DAVY LAMP.

(*Concluded from page* 80.)

The circumstances which render this lamp an instrument of perfect safety may be thus stated: "Flame is gaseous matter heated so highly as to be luminous, and that to a degree of temperature beyond the white heat of metals or other solid bodies. When an attempt is made to pass flame through a very fine mesh of wire gauze, the gauze cools each portion of the elastic matter that passes through it, so as to reduce its temperature below that degree at which it is luminous; and the diminution of its temperature is proportional to the smallness of the mesh, and the mass of metallic wire." Moreover, the fine wire gauze is not only a conductor but a radiator of heat; consequently it possesses great cooling power; and when by this, or any other means, we cool a body of flame, the effect of cooling it will most certainly be to extinguish it. The wire gauze which encircles the lamp does not prevent the passage of the inflammable gas, but it prevents its emission in a state of inflammation; consequently nothing can pass from the interior of a lantern properly constructed, that is, at a temperature sufficiently high to inflame the explosive atmosphere of the mine. The temperature of a metallic body even when white-hot, is far below that of flame; therefore when the wire gauze of the lantern is red hot; it will abstract heat enough from the flame of the fire-damp to extinguish it before it passes through the meshes. So, if a wire gauze sieve be held over the flame of a common lamp, it will prevent the flame from passing it, al-

though the heated air which passes through will be hot enough to char a piece of paper held above the sieve; a phenomenon which is precisely similar to that exhibited by the wire gauze cylinder. A very simple experiment for the further illustration of the effect thus produced, has been suggested by Sir Humphry Davy. "Let" says he, "the smallest possible flame be made by a single thread of cotton immersed in oil: it will be found to be about one thirtieth of an inch in diameter. Let a fine iron made into a circle of one-tenth of an inch in diameter, and brought over the flame. Though at such a distance, if it be cold, it will instantly extinguish the flame, but if it be held above the flame, so as to be slightly heated, the flame may then be passed through it. That the effect depends entirely upon the power of the metal to abstract the heat of the flame, is shown by bringing a glass capillary ring of the same diameter and size over the flame: this being a much worse conductor of heat, will not extinguish it even when cold."

## GLASS STOPPERS.

### BEST MODE TO EXTRACT FROM BOTTLES.

*To the Editor of the Penny Mechanic.*

SIR,—Observing in the last Number of your Magazine (No. 10) a query to ascertain the "best mode of extracting glass stoppers," I beg leave to state, that the mode that has been tried with the greatest success is a very simple one —namely, to immerse the neck of the bottle in boiling hot water, and drawing it out immediately to give the stopper a sharp twist with the fingers. If the first trial should not prove efficient, the bottle should be wiped dry, and the experiment repeated. The reason of this is the momentary expansion of the neck of the bottle by heat.

I have, myself, tried many ways, but none ever succeeded so well as the foregoing, which you would oblige me by inserting.

The water should not be boiling, or it would most probably break the bottle. The water could be allowed to increase its temperature while the bottle was immersed.

HENRY MARTYN BAKER.

Another correspondent, C. D. T., recommends a similar plan; or that a cloth wetted with hot water should be wrapped round the neck of the bottle—the heat will cause it to expand, and the stopper can then be withdrawn, as it will not have been expanded by the heat of the water.

C. M. recommends placing the bottle in water, and letting the water boil, by which means if the bottle contains a liquid, sufficient steam will be generated to force the stopper out. If the bottle is empty the same effect will be produced by the air being expanded.

## INSTITUTIONS.

*The Mutual Instruction Society* meeting at the Southampton Coffee-House, Southampton-buildings, Chancery-lane, held a *Conversazione* on Thursday evening last. An excellent address on the occasion was delivered by the Chairman, after which several humourous recitations were given by Members, and the late Secretary was presented with "Combe's Physiology," handsomely bound, as a mark of respect of the members for the services rendered by him to the Society. Some very fine drawings by Mr. Foggo, and some by members of the society were exhibited. Also beautifully executed casts of the Lacoon; Venus de Medici; Rape of the Sabines; Mercury; Mary Magdalen, and other celebrated pieces of sculpture. There were also a variety of interesting specimens of the works of Nature and of Art exhibited. The entertainments of the evening appeared to give general satisfaction.

*The Finsbury Mutual Instruction Society.*—The Anniversary of this Society was celebrated on Monday evening last by a supper at the Strand Hotel. Several excellent speeches were delivered, and the company did not separate until an *early* hour.

### LECTURES DURING THE WEEK.

*London Institution*, Finsbury Circus.—Monday evening, Jan. 26, at seven o'clock, Dr. Ritchie, on Voltaic Electricity.—Thursday afternoon, Jan. 26, at one, Mr. Sheridan Knowles, on the Drama.

*London Mechanics' Institution*, Southampton-buildings, Chancery-lane. — Wednesday, Jan. 25, at half-past eight, T. J. Searle, esq., on the Drama.—Friday, 27, Dr. Birkbeck, on Osteology.

*Western Literary and Scientific Institution*, 47, Leicester-square.—Thursday, Jan 26, at half-past eight, E. Cowper, on Calico Printing.

*Istington Literary and Scientific Society.*---Thursday, Jan. 26, at eight o'clock, Election of Officers.

## TO CORRESPONDENTS.

"D. Lewis." We shall perhaps be able to make use of the Sketch at some future time.

"W. C. C." is quite correct.

"M. Rough's," second letter has been received.

"S. T. C." next week.

The Books sent us to notice have also been received.

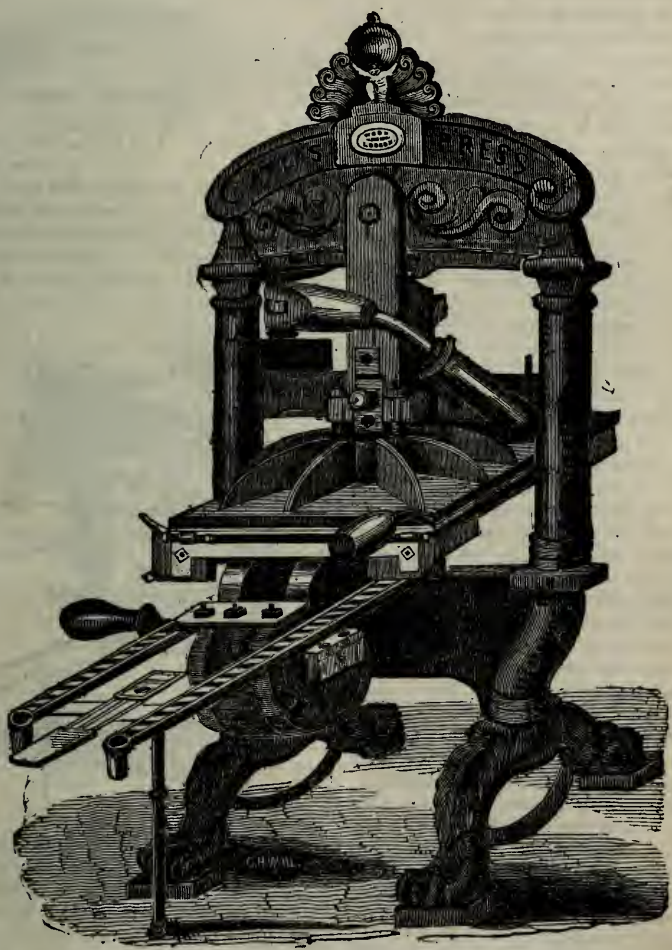
London: Printed at the Holloway Press, by D. A. BOUDNEY; published by BERGER, Holywell-street, Strand; and may be had of all Booksellers.

# THE PENNY MECHANIC.

A MAGAZINE OF THE ARTS AND SCIENCES.

Nos. XIII. & XIV.] JAN. 28, 1837. [PRICE 2*d*.

WOOD'S ATLAS PRESS.



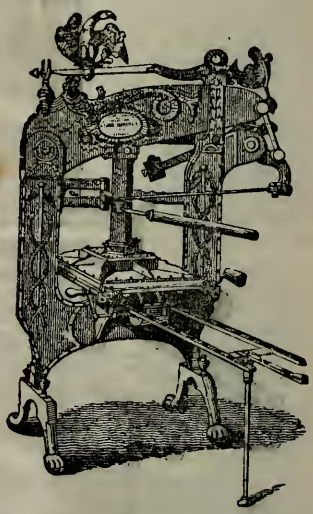
VOL. I.—NOS. XIII. & XIV. Holloway Press: D. A. Doudney.

### WOOD'S IMPROVED PRINTING PRESS.

A short time since we had the pleasure of introducing to the notice of our readers a very ingenious invention of Mr. Hill's, for improving the printing machine. We have, not less pleasure in directing attention to another kind of printing apparatus, a hand-press, invented and constructed by Messrs. Wood and Sharwood, which for simplicity and power is superior to any with which we are acquainted.

In the present day, when in order to meet the increasing demand for knowledge, the various operations in printing are required to be executed with a rapidity, which to our forefathers would have appeared impossible, the steam engine has been called in to supply the place of animal power, and for newspapers and periodicals having a very extended circulation, a printing machine is absolutely necessary. But very considerable improvements yet remain to be effected in printing machinery, before hand-presses can be entirely dispensed with. Amongst the objections to machine-printing, is that of a want of uniformity in its execution; some sheets of paper may be printed with tolerable accuracy, as regards the quantity of ink, and its similar distribution throughout the pages, whilst others are likely to be thrown off the cylinder in a very disproportionate condition. Again, the commonest ink is used in printing by machinery, on account of its thin texture; the finer description of inks being of a stronger and thicker substance, the cylinder will not allow sufficient time for it to distribute itself equally over the roller, ere it had performed its revolution, and the type-form had returned to the rollers for its wonted supply of ink. The consequence is, the ink would appear in patches. On these, and many other accounts, hand-presses are invariably adopted where fine work is required; as experienced pressmen, by an attentive regard to the size and thickness of the type, substance of the paper, &c., can afford a moderate yet frequent and full supply, and thus insure the production of a volume beautifully clear and proportionate throughout.

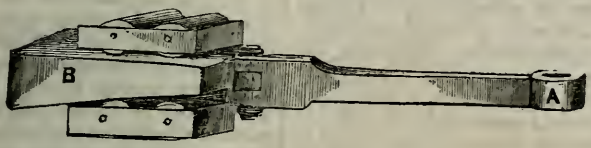
Till about the commencement of the present century, the printing-presses employed were of a very inferior character, the only one in general use was that constructed by a Dutchman named Blaew, which though certainly a very great improvement upon the presses used before his time, was very objectionable on many grounds. In a future Number we will give an engraving of this press, when its construction and defects will be better understood than they can be by mere description. Lord Stanhope greatly improved this press, and made it altogether much better adapted to perform the work required of it. His press is still used by many printers, and would no doubt be more generally employed, but that since his time innumerable improvements have been made in printing-presses; and these of course have, to a certain extent, supplied its place. The Columbian press, invented by Mr. Clymer, an American, is perhaps the most powerful and ingenious that has been constructed, and is by many printers preferred to any other. It owes its excellence to an exceedingly ingenious combination of levers, as our wood-cut shows.



In this, as in all hand-presses, the object of the machinery is to bring a flat pressing surface, technically called the platten, upon the surface of the type. The means by which this process is accomplished has been invariably by the employment of one of the simple mechanical powers. In the early presses the

crew was adopted, afterwards, as we ave seen, the lever was employed, in he one we are about to describe the edge is made to produce the effect required.

The power of the wedge is well known, nd it occurred to Mr. Wood, the inentor, that by introducing it into the achinery of the printing-press he should be able to employ a force, which, without occupying much room, would be capable of producing all the effects resulting from more complex machinery. This he has fully accomplished, and from the extensive patronage the press has already received from printers, it appears likely to supersede, to a great extent at least, the presses now in use.




e diagram shows the manner in which wedge is applied, and will enable the der to judge of the immense power to obtained by the simple pulling of at is called the bar-handle from the it to the left-hand side of the press. l this purchase can be either inased or lessened by turning the screw ibited in the front of the press. The owing letter, which we have just reed from our printer, affords, we k, satisfactory proof of the successful king of these presses.

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Dear D——.

"You ask me my opinion of the s printing press. I have had one in use for nearly six months, and am happy to inform you that I have found it as effective in its operation, and rapid in its movement, as it is simple in its construction. As far as my humble judgment extends, I think it one of the most successful pieces of mechanism ever presented to the public; it requires but little labour, is free from the liabilities to accident which most other presses are exposed to; occupies but small space, and, what is most desirable, produces an even and beautiful impression.

"Yours, truly,

"D. A. Doudney.

"Holloway Press, Jan. 1837."

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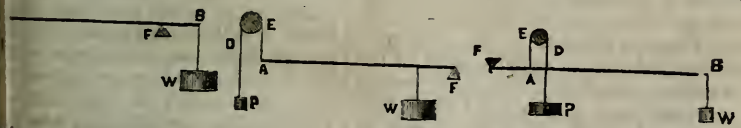
BIRKBECK COLLEGE

## THE LEVER.

FIG. I. FIG. II. FIG. III.




'ever is a *simple* mechanical power, called simple because it can be without the aid of another ma-. It is formed with a straight f wood or iron, resting upon some as a prop or fulcrum, on which centre it turns. There are three of levers, in the *first* and most on kind, the fulcrum is between eight and the power; in the *second* the weight is between the fulcrum and power; and in the *third* the power is between the fulcrum and weight. Fig. 1. represents a lever of the *first* kind, the fulcrum or prop F being placed between the power P and the weight W; the power gained by the lever is in proportion as the arm A F, in length is greater than the arm F B, that is, if the arm A F be six feet long, and

the arm F B only one foot long, a power of one pound acting at A will balance a weight of six pounds acting at B, and if the arm A F be twelve times as long as the arm F B, the power gained will be as 12 to 1. This kind of lever is most commonly used to raise heavy weights, as large logs of wood, great stones, &c., to small distances, in order to pass chains or ropes under them, for the purpose of raising them to greater heights with more powerful machines; in this application of the lever, the extremity of its short-arm is put under the weight to be raised, a fulcrum is formed with a stone or block which is placed as near that end of the lever as possible, and the power or exertion used to move the weight is applied at the end of the long-arm of the lever. But in the practical use of this kind of lever, the short-arm F B should balance the long-arm A F, which may be done by increasing the thickness of the shorter arm. If the extremities of each arm of the lever were the same distance from the fulcrum, it would represent the beam of the common balance, with which different sorts of commodities are weighed, but the power gained being in proportion, as one arm of the lever is longer than the other, by this there would be no advantage received. The *steel-yard* is a lever of the first kind, which Fig. 1. may represent; the short-arm F B is, by an increased thickness, made to counterpoise the longer one A F, so that the lever when it is unloaded (except by the scale, which is suspended at the end of the short-arm) will hang in a horizontal position, now if a weight of one pound be hung on the long-arm as far from the fulcrum as the point B is, it will balance an equal weight in the scale suspended at B, but, if the weight be moved to 2, 4, 6, or eight times that distance from the fulcrum, it will be in equilebrio with a weight of 2, 4, 6, or 8 pounds in the scale, the distances from the fulcrum being respectively 2, 4, 6, or 8 times greater than B is. The poker when used for stirring the fire represents a lever of the first kind. The coals acting as the resistance or weight, the bar of the stove on which it turns the fulcrum, and the exertion at the handle the power; many common instruments continually under ou notice, may also be referred to thi kind of lever: as scissars, snuffers pincers, &c.

A lever of the *second* kind, which ha the weight between the fulcrum an power is represented by Fig. 2. Th power gained by this kind of leve being calculated the same as in th former, it is evident that, if a weight of six pounds hung one foot from th fulcrum F, and a power P of one pou hung at A, six feet from the fulcru by means of the cord D passing ov the fixed pulley E, the advanta gained will be in the proportion of to 1, or a power of one pound at P w balance a weight of six pounds at A pole supporting some heavy burde carried between two men, represe a lever of this kind; and if the abili of one man, be greater than that of t other, by putting the weight as mu nearer the stronger man than t weaker, as the strength of the forn exceeds that of the latter, each m carry a weight in proportion to strength; oars used to propel boats the water are referable to this kin lever, the water acting as the fulcr the boat to move the weight, and boatman at the handle the power; this lever may also be referred, d which turn on hinges, cutting-kni which have one end fastened to a bl rudders and masts of ships, n crackers, &c.

The *third* kind of lever (Fig. 3.) the power between the weight and crum; therefore, the power b nearer to the fulcrum than the wei it is clear that if a weight W of pound act at B four feet from the crum, it will require a power P of pounds made to act at A, one foot the fulcrum, by the cord D going the fixed pulley E, to balance Therefore as no advantage is ga by this sort of lever, it is never but in cases of necessity, as in pla a ladder against a wall, one end being fixed, while by the strengt the man raising it, it is put in an right situation. The limbs of ani are constructed on the principle o kind of lever; the arm for instance joint at the elbow is the fulcrum muscle the medium through whic

power acts, and the weight to be raised by the hand the resistance.

In conclusion, it must be remembered that the *space* passed through by the power, will be as much greater than that passed through by the weight, as the distance of the power from the fulcrum exceeds the distance of the weight from the fulcrum, so that, *strictly speaking*, there is no acquirement of power by means of the lever.

S. T. C.

## CURE FOR WASP STINGS.

*To the Editor of the Penny Mechanic.*

Sir,—Some time last Summer my mother was stung by a wasp; at the suggestion of my brother she applied carbonate of soda to the wound, and was immediately relieved from the agony produced by the sting.

A few days after a boy in my father's employ came crying into the shop, a bee having stung him on his eye-lid. It had commenced swelling; the carbonate of soda was again tried, and with the happiest results; he was immediately eased of the pain, and experienced not the slightest inconvenience from the sting afterwards.

Yours, &c., Thos. Engall.

## CHEMICAL RECREATIONS.

### ON MAKING EXPERIMENTS.

The chemical properties of a substance characterise equally the smallest portion of that substance, or the greatest mass. That which can be demonstrated of a pound, can also be demonstrated of a grain. Hence chemical experiments may be performed, either with large portions of matter, or with small portions; and whether in any case a large or small portion should be operated upon, is a thing to be determined solely by expediency. In trade, where productive experiments are made with a view to obtain preparations for sale, the quantities operated upon are often extremely large, amounting to many tons in weight. In analysis, the quantity of a body submitted to a test weighs sometimes but the fraction of a grain. When a lecturer has to teach chemistry to a large audience, it is his duty to make his demonstrative experiments upon rather a large scale, otherwise a majority of the persons present may not be able to perceive what takes place. And whenever a theory is built upon a single experiment, the lecturer should take particular care to make this experiment in such a manner that every person present may see and comprehend it fully; for if the demonstration is not made to *tell*, the theory sinks unheeded, and the arguments grounded upon it are fustian. I give this hint to the Members of Mechanics' Institutions, who have lately adopted the useful practice of lecturing to one another.

As the demonstrative experiments of the lecture-room are unavoidably scanty and unsatisfactory, the student who desires to know somewhat more of the science than he can learn there, must necessarily pursue his studies at home. I recommend him to be very cautious in believing the dogmas he hears and reads, without seeing the experiments which are intended to verify them. It is indispensably necessary, that he perform with his own hands the fundamental experiments of chemistry, in the best manner his time, his apparatus, and his means will admit of. He will find it of importance in this case to operate upon extremely small portions of matter; for he will then not only save time and money, but often be enabled to perform a successful experiment, where, by operating upon a large mass, he would as certainly fail. The preparation of the gases, the formation and crystallisation of salts, the application of tests, and a thousand other entertaining and instructive experiments, can all be performed by the student, better on a small scale than in the large way; nay more, a student in his closet very frequently succeeds in performing an experiment which fails on the lecture table of the professor; for the accidents which attend the hurry and business of a lecture-room produce unavoidable disappointment. This therefore is a circumstance of which the chemical student should be prepared to take every advantage. The faculty of experimenting with accuracy, facility, and economy, ought to be gained as

speedily as possible; for it is upon that faculty that the progress of the young chemist is principally dependent.—*Griffin.*

## THE MINER'S FUND SOCIETY.

A Society is about being established for the purpose of assisting the widows and families of miners who may be killed by sudden explosions or other accidents in mines. The plan on which the society is to be formed, is not yet definitely determined on, but the necessity for some association of the kind must be evident to every one who considers the many accidents to which miners are liable, and the few opportunities they have for providing against a time of sickness, or for protecting their families from want in case of death. The editor of the *Mining Gazette* in his paper of last Saturday, eloquently remarks upon the subject. "No accidents are so frightful as those to which the miner is subject—no foresight can calculate on their occurrence—no forethought can provide against them. Unseen, unheard, almost without intimation, in a moment of jocular hilarity, or diligent exertion, the feel monster swoops, in an instant, upon his prey—without even a chance of escape his victims are overwhelmed, until their mangled and appalling forms present the dreadful evidence of his fury. The bereft widow is left to mourn, in chill distress, through a long life of lonely sorrow, while her fatherless orphans, half unconscious of their loss, until opening intellect enables them to perceive the hardship of their fate, are brought up to endure the same toil, and perhaps abide the same lot as hurried their unfortunate parent into eternity." While we cannot forbear remarking that many, and very many, of the working classes are exposed to dangers, nearly, if not quite as great as those of miners, and are equally deserving to be provided for in cases of distress and sickness, at the same time, we would earnestly impress upon all who have the means of assisting the Society about to be formed, that they cannot bestow their money in a manner more benevolent and with greater probability of its producing a beneficial effect.

## EXTRAORDINARY EXPERIMENT.

*(From the Somerset County Gazette.)*

We feel much pleasure in communicating to our readers the following singular experiment of our now celebrated neighbour, Mr. Andrew Crosse. The public are aware that Mr. Crosse has been recently pursuing a series of researches into the process of crystallization by means of his galvanic batteries, and that he has made discoveries which have thrown quite a new light upon science. Some weeks ago he prepared a silicious fluid for the purpose of crystallization. He heated a flint to a white heat, and then plunged it in water to pulverize it. The silex, thus reduced, was saturated to excess with muriatic acid. The mixture was placed in a jar —a piece of flannel was suspended in it, one end of which extended over the side, and thus, by capillary attraction, the liquor was slowly filtered, fell into a funnel, and thence dropped on a piece of iron-stone from Mount Vesuvius, upon which were laid the two wires connected with either pole of the battery.—We should state that the iron-stone had been previously heated to a white heat, so that no germs of life could have existed upon it. Mr. Crosse made his daily observations of the wires to discover the beginning of the process of crystallization. On the 14th day he saw some small white specks upon the stone. Four days afterwards they had elongated, and assumed an oval form. He concluded that they were incipient crystals. Great was his surprise on the 22d day to find eight legs projecting from each of these white bodies; still he could not believe that they were living beings. But on the 26th day his surprise was complete; there could be no doubt they moved, they fed, they were perfect insects,—18 or 20 of them have since appeared. Many persons have seen them, but there is no record of such an insect. It is in form something like a mite. It has eight legs, four bristles at the tail, and the edges of the body are very bristly. Its motions are visible to the naked eye —its colour is gray—its substance is pulpy. It appears to feed upon the silicious particles in the fluid. The most extraordinary circumstance in this phenomenon is the nature of the fluid in

which this insect lives and thrives. The acid instantly destroys every other living being. But a second trial has confirmed the fact beyond a doubt. Another portion of silex was prepared in the same manner, and reduced to a gelatinous form, but without the acid. A coil of silver wire was suspended in it from one of the poles of the battery, and the other pole was also immersed, so as to send through the mass an incessant stream of the electric fluid. About three weeks afterwards Mr. Crosse examined the poles to search for crystals, and in one of the coils of wire he found one of these strange insects. This proves that it is produced from the silex, and not from the acid. Mr. Crosse, with his usual modesty, has contented himself with stating the fact, without attempting to account for it. He is in correspondence with Professor Buckland upon the subject, and the learned professor has suggested an explanation, which it will be for future observers, by repeated experiments, to confirm. We should state, that the insects were principally found at the negative pole of the battery. A German naturalist has recently discovered that silicious and other rocks are chiefly composed of the remains of insects. May not the germs of some of them, released from their prison-house, and placed in a position favourable to the development of vitality, have sprung to life after a sleep of thousands of years?

[The above account has been going the round of the newspapers during the last fortnight, but we are inclined to think the story will turn out very similar in many respects to that of the "three black crows." The last paragraph is enough to make us incredulous; besides, the account contains statements of a very doubtful character. We should like to know *why* "the iron stone had been previously heated to a white heat?" We should also very much like to see a flint stone "reduced to a *gelatinous* form," either with or without acid! The experiment would no doubt be highly gratifying to chemists. Mr. Crosse does not appear to have communicated his wonderful discovery to any of the philosophical journals of the day, and as it has merely appeared in the newspapers, at a time when many murders and dreadful accidents are *manufactured* to supply the deficiency of the parliamentary debates, we are inclined to think the statement all —fudge!] ED.

## CHEMICAL RECREATIONS.

### EXAMPLES OF AFFINITY.

TAKE a little common magnesia, and pour by degrees diluted nitrous acid upon it till the whole of the earth be dissolved. This is an instance of simple chemical affinity. But if a solution of potash be poured upon the former mixture, the potash having a greater affinity for the acid will take it from the magnesia, and the magnesia will again be precipitated.

To a solution of soap add a little weak sulphuric acid. The acid having a stronger affinity for the alkali of the soap than the alkali has for the tallow, the acid will unite with the alkali, and the separated tallow will be seen to float upon the surface of the liquor.

Dissolve a few ounces of sulphate of iron in water, by adding the salt by degrees till the liquor becomes turbid; then, if a skain of cotton thread be dipped in the solution and shaken a little in it, the thread will take up the whole of the oxide of iron, and render the liquor transparent. The effect is produced in consequence of the great affinity which cotton has for the oxides of iron.

If mercury be put into a *glass* bottle, the surface of the mercury will appear convex, owing to the small affinity which mercury has with glass; but if it be put into a *metallic* vessel, the surface of the mercury will appear concave like that of other fluids, because of its tendency to combine with the sides of the vessel. This may be adduced as a striking proof of metallic elective attraction.

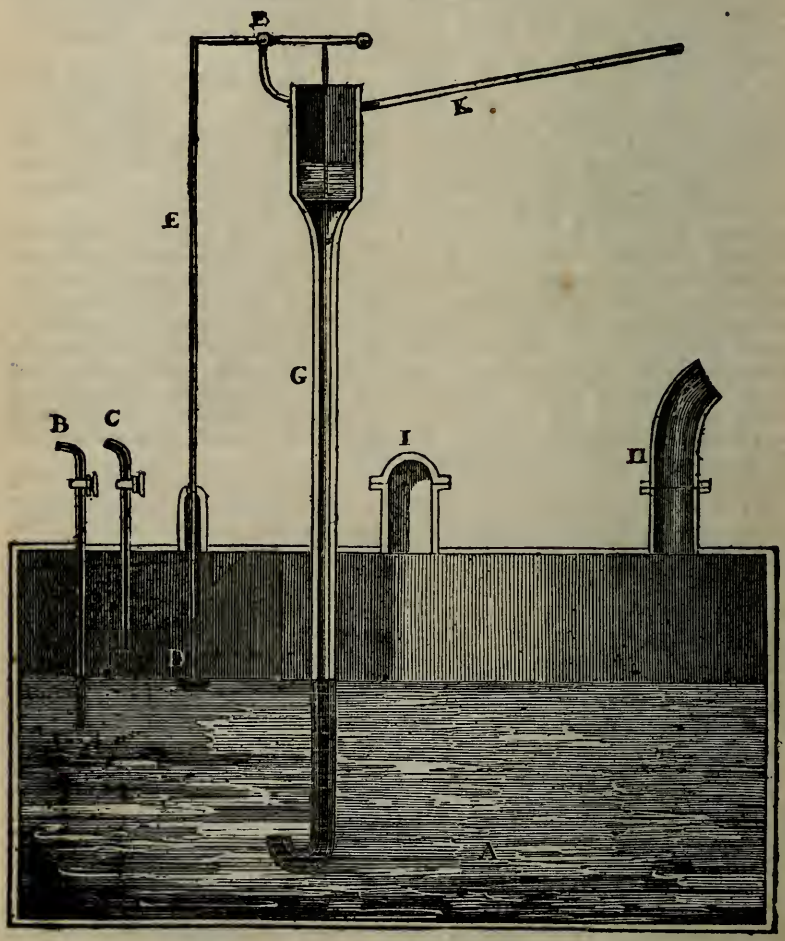
The phenomena of dyeing may also be referred entirely to chemical principles. The colouring particles possess chemical properties that distinguish them from all other substances; they have attractions peculiar to themselves, by means of which they unite with acids, alkalies, metallic oxides, and earths. The difference in the attractions of the colouring particles for wool, silk, and cotton, is sometimes so great that they will not unite with one of these substances, while they combine very readily with another;

thus *cotton* receives no colour in a bath which dyes *wool* scarlet.

Chemical affinity may be pleasingly illustrated by the composition and decomposition of writing ink. Take a little tincture of galls, and a little of the solution of green copperas, both colourless liquors, and, if poured together, the mixture becomes black; from the affinity which gallic acid has for the oxide of iron in the copperas. Then pour in a little weak aquafortis, and the liquor will become immediately transparent: this arises from the metal leaving the first acid to unite with the last, to which it has a greater affinity. But if a solution of potash be now added, the nitrous acid will quit the iron, and unite with the alkali: thus the iron, being once more disengaged, will again be caught by the gallic acid in the infusion, and once more produce a black liquor.

PARKES.

MODE OF FILLING BOILERS.




THE above engraving representing a boiler in which steam is generated, is of too much importance to pass unnoticed. A represents the interior of the

steam boiler. D is a stone float suspended by the wire E to one arm of a lever F, and is so counterpoised by the opposite extremity of the lever, that it always remains at the surface of the water in the boiler; its specific gravity, which would otherwise cause it to sink in the water, being diminished by its connection with the lever. B and C are two pipes communicating with the interior of the boiler, the lower extremity of the former being immersed in the water, and that of the latter terminating at some distance above its surface. The small pipe K is employed to supply the water admitted by the operation of the stone float D, and which, descending by the pipe G, is seen to enter the boiler. H is the steam pipe, through which the steam passes into the cylinder, and I is a man-hole, to enable a person to enter the boiler for the purpose of cleaning it, and removing the stony concretions deposited by the water.

With reference to the quantity of water in a boiler, the principal question, exclusive of the saving of heat, is to determine how far the depth or shallowness of the water in the boiler may influence the production of steam.

If the parts of a mass of water could preserve the same relative positions during the application of heat, and this heat were applied at the bottom under a depth of six feet, it would depend upon the conducting power of the fluid whether the upper or lower parts should give off the greatest quantity of steam in a given time. If the lower parts were to afford the greatest product, this would be done under a greater pressure and at a higher temperature; so that it would become an object of experimental research, whether such steam, by giving out heat to the superincumbent water through which it must rise, and rendering a portion of it elastic, might not be as effectual in its ultimate operations, as if the heat had been employed upon a shallower mass.

## ON LIGHT.

The nature of light has ever been a subject of controversy. It was Newton's explanation that luminous objects give out particles of inconceivable minuteness, and moving with extreme velocity. "What mere assertion," says Sir John Herschel, "will make any man believe that, in one second of time, in one beat of the pendulum of the clock, a ray of light travels over 192,000 miles; and would therefore perform the tour of the world in less time than a swift runner would make one stride?" In short, there is nothing like it but the influence of attraction; which is so instantaneous as to admit of no calculation of time at all. A different theory from that of Newton was suggested by Huyghens, who supposed a highly-elastic fluid to fill all space, and which, when moved, produced the effects ascribed to light. Instead of minute particles diverging from the luminous body, he substituted waves or vibrations, propagated through this elastic ether. The late Dr. Young, and some continental philosophers more recently, took up this hypothesis and supported it by ingenious experiments. But notwithstanding that it is the favourite theory of the day, difficulties appear still to encumber it, The theory of undulations implies the advance and recoil of the elastic medium, and that gives the idea of retardation. The supposition of light being the effect of the motion of an ether, does not fall in with our conceptions of the manner in which it enters into the composition of bodies, or influences chemical combinations, or affects the living power of animals and vegetables. The merits of the two theories, however, need not be discussed here. It will be sufficient for our purpose to enter on the explanation of a few of the laws which influence a ray of light in passing through transparent media.

When the ray of light passes perpendicularly from a rarer into a denser medium, as from air into water, it suffers no change in its direction; but when it passes obliquely, it takes a new direction towards the perpendicular, making a sudden angle, as if broken,—and this is refraction. Two circumstances, therefore, influence the ray of light;—the angle at which it falls, and the density of the body into which it passes. When the ray passes from the denser medium into the rarer, it is again refracted, but away from the perpendicular, and takes

its original course, provided the surface at which it goes out is parallel to the surface at which it entered. When a ray strikes upon a body that is not transparent, or only imperfectly so, it is in part reflected, that is, struck off again, bent back, or reflected, and enters the eye, conveying to us the impression of the form and colour of that object. But the expression which we have used requires explanation; for how is it that the reflected rays should convey the idea of colour? The prism is a piece of glass so formed that the rays must fall obliquely on one or both of the surfaces, and suffer refraction. Thus a ray striking into the prism is refracted; but all its parts are not equally refracted, and as the light consists of parts differing in colours, and which are differently refracted, it is divided or dissected into several colours, called the prismatic colours. The spectrum, as it is termed, thus formed, consists of seven colours; that which is least refracted being red, and in succession orange, yellow, green, blue, indigo, and violet. If these rays be re-compounded by passing through a convex lens, which, owing to the obliquity with which they fall, draws them to a point, the focus of the light will be again colourless. Some modern philosophers have reduced these prismatic colours of Newton to three primary colours, red, yellow, and blue; contriving, by the super-position of these, to produce the seven tints; while others have, on considerations not easy to be disproved, held that there is not any definite number of colours, but a gradation of tints from the extreme red to the extreme violet. We may now understand the reason of the colour of objects. When light strikes upon a body, even upon the most transparent, part penetrates, part is reflected, and some part is lost. A dye is a disposition given to the surface of cloth to repel some of the rays of light more than the others; and the colour will be according to the ray, or the combination of rays, thus cast back and sent into the eye.

And here it is natural to reflect on the variety and beauty everywhere bestowed through this property of the beam of light. What a dulness would have pervaded the surface of the earth if there had been only a white light! The beauties of the garden and of the landscape would have been lost to us. How is the beauty of the latter enhanced by the almost infinite variety of colour, yet still within that range which is agreeable and soothing to the eye, as well as consonant to our feelings! The human countenance, too, although capable of exciting our warmest sympathies by form and motion alone, has that beauty perfected by colour, varying under the influence of emotion.

It remains, in order that we may apply these facts to the explanation of the structure of the eye, to show how the rays proceeding from a body and falling upon a convex glass suffer refraction. The ray that strikes upon the centre, being perpendicular to the glass, passes on undeviatingly. But each ray as it strikes a point removed from the centre, must impinge with more obliquity, in consequence of the curved surface; and as the refraction of all the rays will be in proportion to the obliquity of their incidence, they will converge towards the central direct ray.

### THE EYE COMPARED WITH OPTICAL INSTRUMENTS.

It is surprising that the structure of an animal body should so seldom be taken as a model. In the history of inventions, it appears quite extraordinary that the telescope and the microscope should be modern, when, as it should seem, the fine transparent convexity of the eye might have given rise to imitation, as soon as man learned to give shape to natural or artificial glass. It reminds us of the observation of Locke, in speaking of a discovery, that it proved the world to be of no great antiquity. Yet we must estimate the invention of the telescope and microscope as by far the most important in their consequences of either ancient or modern discoveries. The first opens to us an unlimited expanse, not only of new worlds, but systems of worlds, and new laws evinced in the forces which propel and attract these; since in the heavenly bodies we find no material contact, nor pressure, nor impulse, nor transfer of power—nor effect of heat, nor expansion of gases—nothing, in short, which can be illustrated by mechanism. By the microscope, we contemplate the minute struc-

ture of animals and things but for its aid invisible: the balance of the cohesive and repulsive forces as they order the changes in the material of the world, and in that of our own frames. Yet these instruments are not in contrast with the eye: but through the comparison of them we discover the wonderful adaptations of that organ; of which it has long ago been said, that it can at one time extend our contemplations to the heavenly bodies and their revolutions, and at another limit its exercise to things at hand, to the sympathies and affections of our nature visible in the countenance. If we put aside the consideration of the living properties of the organ, as the extraordinary variety and degrees of sensibility in the nerve of vision, and confine ourselves to points easily comprehended, as, for example, the mechanism of the eye, and the laws of optics as applicable to the humours, we shall find enough to admire. When we look upon the optician's lens, however perfect its polish may be, we can see its convex surface: that is to say, the rays of light which strike upon that surface do not all penetrate it, but are in part reflected to our eye, which is the occasion of our seeing it. We do not see the surface of the cornea of the human eye. Here, then, is an obvious superiority, since it implies that all the rays of light which strike the cornea enter it and are retracted, and none are returned to our eye. If we take the optician's lens between our fingers and hold it under water, we can no longer see it, however transparent the water. The reason of this is, that the rays of light are reflected when entering from a rare medium into a denser, more abundantly in proportion to the difference of the density. When the ray of light has penetrated the water, it also penetrates the glass, because there is not that difference of density between the water and the glass which there is between the atmosphere and the glass. From this we may estimate the importance of the surface of the cornea being moistened by the tears; for however thinly the water may be spread over the surface of the eye, it is sufficient to make those rays that would otherwise be reflected penetrate the cornea. The whole humours of the eye are constituted with a regard to this law. There is nowhere an abrupt transition from a rare to a dense humour. The ray is transmitted from the cornea into the aqueous humour, and through that humour into the lens or crystalline humour. Were this latter humour uniform and of the density of its central part throughout, the ray would be in part reflected back from its surface. But it is not uniform, like a mass of glass: it consists of concentric layers increasing in density from the surface to the centre. If we first look at the entire lens, and then take off its concentric layers, we shall see the surface of the internal nucleus more distinctly than the exterior and natural surface. The reason is obvious: the nucleus is so much more dense than the atmosphere, that the reflection of the rays from it is more abundant. We now comprehend how finely it is provided that the crystalline lens should be surrounded with the *liquor Morgagni*, a fluid which is but in a slight degree more dense than the aqueous humour. The exterior surface of the lens itself is only a little more dense than the surrounding fluid, and each successive layer, from the surface to the centre, is of gradually increasing density: so that if we were to describe the course of the ray, it would not, as we see in the ordinary diagrams, pass like a straight line of the pen, but in a curved line, showing the gradual manner in which the ray is refracted through successive transparent layers. As it enters in the anterior half of its passage, it encounters media of increasing density: but as it passes out behind, it is transmitted through media diminishing in density. The ray is nowhere opposed by that sudden increase of density which gives a disposition to reflection; and it passes through the vitreous humour still refracted, the density of that humour having a just correspondence with the posterior surface of the lens. In the atmosphere there is a similar arrangement for receiving the light proceeding from the sun or stars: for as the density of the air diminishes as the height above the earth increases, the surface of our atmosphere, from its rarity, must almost resemble free space; consequently the light falling into it will penetrate more abundantly than if the air were compressed as it is near the earth, and were of uniform density. We

thus see the obvious superiority in the structure of the eye to any thing that can be composed of glass, which is of uniform density throughout, and must therefore present a succession of surfaces where rare and dense media are abruptly opposed to the rays transmitted. We may observe another happy result from the peculiar structure of the lens. A magnifying glass is never true: an aberration of the rays takes place in the pencil of light, as the rays are drawn to a focus. The rays which penetrate near the centre are projected so as to be drawn to their focus beyond those rays which pierce through nearer the edge. The rays penetrating the centre of this double convex glass will project the image to a greater distance than those penetrating nearer the circumference, and consequently falling more obliquely, will form a focus nearer the lens. But in the crystalline humour of the eye, which corresponds with the optician's lens, the exterior layer having less density, and therefore a diminished property of refracting the ray, the image is carried farther off; and by this means it is ordered that wherever the ray penetrates, it shall be drawn to an accurate focus. Some modern philosophers have asserted that the eye is not perfectly achromatic in every adjustment. The term implies the property of the instrument to represent an image divested of the prismatic colours; those false colours which attend the refraction of the rays of light. If the statement be correct, it is nothing against our argument; nor have those inquiries advanced it with any such view. We know that in all the ordinary exercises of the eye the image is perfect, having neither penumbra nor prismatic colours. This property of the eye results from the different media through which the rays are transmitted, and the gradual transmission which we have just mentioned. Dollond's achromatic glasses, a great improvement upon the telescope, were made on this principle. He composed the object-glass of the telescope of crown-glass and flint-glass, so that while, by the combined effect of their convexities, they drew the rays to a focus, the dispersive power of the one was counteracted by that of the other. Let us endeavour to explain this. A beam of light, being composed of the different coloured rays, passes through a prism. Instead of passing onward in a straight line, it is refracted in distinct, and, consequently, coloured rays. Whilst the whole of them are bent or refracted at an angle, they are also diverging from one another. Their deviation from the straight line is their *refraction:* their diverging from each other is their *dispersion.* These properties being distinct, it is conceivable that glass of a different chemical composition may affect the one to a greater degree than the other, and, therefore, that a lens may be composed of different kinds of glass (crown-glass and flint-glass, for example), so that the convergence of the rays into a focus may be obtained without the dispersion of the rays, and the consequent production of false colours round the image. This is what Dollond nearly accomplished, and upon these principles. That the effect of this very artificial arrangement is attained in the eye is a remarkable proof of the perfection of its adaptation to the properties of light. The last circumstance which we may mention in continuing the comparison, is the drawing out of the tube in the telescope to accommodate the foci of the glasses to the distance of the object. It is sufficient to say that the eye possesses this property of accommodation. That we do not understand how the operation is performed, only strengthens the argument in favour of the perfection of the eye: since the power exists, and is exercised with an ease which hardly permits us to be sensible of it.

Sir C. Bell.

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Write upon paper with a diluted solution of muriate of copper; when dry it will not be visible, but on being warmed before the fire the writing will become of a beautiful yellow.

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*To the Editor of the Penny Mechanic.*

CONSTRUCTION OF RAILWAYS.

Sir,—Mr. Vignoles, civil-engineer, has published, in the form of a report to the directors of the Midland Counties Railway Company, a plan for making the Upper Works of Railways; by adopting which, he proposes to save, in two trackways, from £800 to £2,200 per mile. He might have said much more; and I

fully concur in opinion with him, that "a more economical and better mode of construction might have been adopted by the Directors of the London and Birmingham, and other principal Railways now in the course of construction," than that to which, despite the report of Professor Barlow, and the other warnings they have had, they seem, by some fatality, resolved to adhere; in which opinion, I unhesitatingly assert, the shareholders in the London and Birmingham Railway will also concur, when, at no great distance, they will be informed that the directors must have fresh powers, either to issue an additional number of shares, or to borrow additional sums on mortgage, either being to the manifest detriment of the original shareholders, over whom the money lenders, in whatever form they may present themselves, will have a decided advantage. It is now too late for the shareholders of the London and Birmingham Railway Company, and those of the other Railway Companies alluded to by Mr. Vignoles, to profit by his judicious, though sarcastic reflections; but other companies may take the hint, and avoid the rock on which their inexperienced, if not obstinate, predecessors have split.

Mr. Vignoles, however, understands theories somewhat better than making calculations and estimates; for he writes down the cost of a stone sleeper, of five cubic feet, (which weighs from 6 to 7 cwt.) 4*s.*; whereas the lowest price at which granite, or other equally hard and suitable blocks, can be procured at any quarry, is about 1*s.* per foot; and, whereas the cost of transport from the quarry to any spot on the London and Birmingham line, cannot, upon the average, be less than 20*s.* per ton, which is 6*s.* 6*d.* per block. I know that 7*s.* 6*d.* each is asked for Yorkshire blocks, (not granite) in the River Thames; to which price are to be added lighterage, unloading into canal boats, canal conveyance to the spot nearest to the railway; landing, loading, and cartage to the railway, and hauling along it (perhaps some miles,) to the place where the blocks are to be laid down.

Mr. Vignoles' plan is to use fir planks, 9 inches wide, and 4½ thick, bedded on ballasting, which is loose gravel, as a continuous support of his frame work, on which are mounted rails, at the top resembling the rails at present in use, though their base is 5 inches, and they weigh 48 lbs. per yard.

Now, as this gentleman advocates the continuous support of the rails, and represents wood, even fir, to be a much better bearer for rails than stone blocks, it is singular that he should not have called the directors of the company in question to my plan, of which these two objects form so prominent a feature. Of its superiority over the existing mode of construction, we have (at least in reference to these objects) a decided confirmation, as Mr. Vignoles, in respect to theory, is held to be an authority.

Mr. Vignoles intends to hold together the two logitudinal bearers for each track-way by wooden girders, at a short distance apart, so that the whole will form a frame, something like a huge ladder; and to secure the rails to the frame-work by nails or spikes; and if wrought iron rails are used, each track-way, (that is two rails for a carriage to run on,) will, according to his estimate, cost 22*s.* per yard, or 11*s.* for a single line of rail.

Whether loose stones will constitute a continuous, solid foundation, especially on clay and other soft earth; and whether, any dependence can pe placed on the stability of the frame work, that is, its continuing an absolute fixture, considering the nature of the trial to which it will be subjected, I must leave the public to judge, entertaining the opinion, that a decided preference will be given to bearers buried in and consolidated with a bed of concrete; two feet or more wide and deep, and which, for solidity, strength, and durability, will resemble a continuous rock throughout the line.

Then, the species of wood to be employed for bearers. Mr. Vignoles is for fir, which after being kyanized, he supposes will last seven years; but I am for oak, which after undergoing the same process, will last seven times seven years; and during this period no interruption be occasioned to the traffic, by taking up old bearers and putting down new ones. Again, Mr. Vignoles will secure, (that is, if wet, dry, and hot weather permit,) the rails to fir bearers by nails; but screws in oak bearers render my plan independent of the influence of the weather.

Now, as to price: Mr. Vignoles' plan costs 11s. per yard; but I have made known that the maximum price of mine will be 10*s*., though in many, perhaps in most parts of the country, the price will not exceed 8*s*. per yard, even if it does 7*s*.; and were Memel fir to be used instead of oak, and nails instead of screws, a further diminution of 1*s*. per yard, might be made. But who that reflects, would thus economize? Mr. Vignoles' iron rail costs 5*s*. 7*d*. per yard, but mine only 1*s*,; and where he uses four feet of fir, I use only one of oak. He has no means for the bars to expand and contract, but upon my plan this advantage is enjoyed.

In conclusion, I thank Mr. Vignoles for his publication, which, on account of its theoretical data, I deem of great value.

THOMAS PARKIN.

Patent Railway Office,
31, Broad Street Buildings,
16th Jan. 1837.

## THE PROPERTIES OF MATTER.

THE term "matter" has been defined to mean "every thing that has length, breadth, and thickness, and resists the touch;" or it may be said to be "every thing of the existence of which we are informed by our senses." Before a person can understand even the principles of natural philosophy, it is necessary that he should become acquainted with the properties of matter, as on these all his speculations must rest. Matter is of two kinds, organized or unorganized, that is to say, it is either living or dead; both kinds obey the same laws to a certain extent, the former however has properties that are not possessed by the latter.

All material bodies may exist in three different states; as a solid, a fluid, and as a gas or vapour. These changes are entirely dependent on the agency of heat. To illustrate this, let us observe the changes that are produced on water by heat. Water deprived of a portion of its latent heat, becomes ice; this exposed to heat again changes to water, and, by an increase of temperature, it can be formed into steam. Other bodies are acted upon in a similar manner by heat. It causes a repulsion amongst the minute particles that constitute what we term matter, by which means the body they form becomes enlarged, and is specifically lighter. To the agency of heat, then, we are indebted for the various forms under which matter exists, and the various changes that take place in it. Leaving till another period the consideration of the laws which regulate heat, we shall proceed to describe the properties belonging to matter in whatever form it may exist. These are *solidity*, or, as it has sometimes been termed, impenetrability; *inertia; divisibility; attraction;* and *mobility*.

*Solidity*. An ingenious metaphysical theory was propounded some years ago by Bishop Berkeley, which endeavoured to prove that matter did not exist; that as colour was only a sensation, and did not really belong to a body, so our idea of the existence of matter was in like manner only imaginary. Of this theory it has been remarked, that if a man were to run against a post, he would feel something more than an imaginary blow! This arises from matter being impenetrable, and is perhaps the best answer that can be given to the theory. We cannot force one substance into the place occupied by another without displacing the latter, because its solidity will prevent such an occurrence. There are some apparent exceptions to this law. For instance, we can mix a quantity of salt with water, without increasing the bulk of the water; this, however, is not in consequence of the salt forcing itself into the particles of matter which form the water, but because it occupies the minute spaces between the particles of water, that previously existed. The atmosphere, although invisible, is yet a material body, and possesses the property we are describing. If we invert a wine glass in a bason of water, and press the glass down to the bottom of the bason, we shall find that the water will not rise in it above a certain height; this is because the air within it is impenetrable, and must be displaced before the water can occupy its place. If matter did not possess impenetrability, "the great globe itself, and all which it inherits," and not these alone, but the whole solar system, and every star in the firmament, however great their

magnitude, might be compressed into the point of a pin! but as every atom, however minute, occupies a certain space, beyond which it cannot be compressed, the very idea is absurd. The change of volume that steam undergoes in being converted into water, is not owing to the particles which compose it being compressed, but merely to their being allowed to approach nearer to each other, in consequence of a reduction of temperature.

The next property of matter is *inertia*, or that by which it endeavours to continue in whatsoever state it may be in, whether of motion or of rest. Neither of these qualities are peculiar to matter, although by some it might be imagined to have a natural tendency to remain at rest. We know a cannon ball could never put itself in motion, and we know it will come to a state of rest, yet the latter is not produced by the ball itself any more than the former; it results from friction and from gravity: from friction it may be of the atmosphere only, but still this is the cause of its loss of motion. Could we project a body into space, where it would not have to overcome friction, it would continue in motion for ever. We have examples of this in the heavenly bodies; the moon revolves round the earth, and the earth round the sun, without the slightest intermission, because they are not opposed by friction. An illustration of the inertia of matter may be seen in the difficulty with which a carriage or waggon is first put in motion; and, after it has been going some time, it is equally difficult for the horses to stop it suddenly. In both cases matter has a tendency to continue in the state it was—in the former, at rest; in the latter, in motion. When a coach first starts off, the passengers sitting with their faces to the horses fall backwards; those sitting with their backs to the horses, fall forwards. A man standing up in a boat, when it first puts off from the landing-place, will in like manner fall backwards, unless he is careful. If we place a card on the top of the finger, and put a halfpenny above it, over the point where the finger touches the card, we may, by giving the card a smart blow on the edge, make it fly off, leaving the halfpenny behind, because of its inertia. The reverse of this experiment may sometimes be seen to take place with an unskilful horseman. If the horse, while trotting rather quickly, be stopped suddenly, the rider will be thrown over its head, because the inertia of his body will not allow him to come to a state of rest at the same time with the animal he is riding.

We shall continue this subject, and describe the other properties of matter in a future paper.

## THE STEAM GUN.

The steam gun is formed simply by introducing a barrel into the steam generator of any engine, and by the addition of two pipes towards the chamber of the gun, which by the action of a handle to the chamber are dropped into the barrel, and fired one by one, at the rate of several hundred in a minute. When a force of 840 lbs. to the square inch is applied, a musket ball, fired at an iron plate 100 feet distance from the gun, is actually driven to pieces in such a way, that none of its fragments can be collected. These guns are said to be more safe than the common guns. Ten cannons upon this principle, it is stated, would in a field of battle be more than equal to 200 on the present system; and a vessel of only 6 guns would be rendered more than a match for a 74: of 500 balls fired every minute from one of these guns, if only one out of 20 were to reach the mark, ten of such guns would destroy 150,000 men daily. By many the perfection of the invention is hailed as a benefaction, which will put a stop to wars and to tyranny; for say they, as a few of these guns would sweep away whole armies from the face of the earth, where could the supplies of men be found, and what tyrant could oppress a people who were possessed of them.

We purpose giving an engraving of this next week.

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*The Liverpool and Manchester Railway* was measured last week by order of the directors, and was ascertained to be 30¾ miles and 33 yards long.

### MANUFACTURE OF SHOT.

The manufacture of small shot is a curious process. In melting the lead, a small quantity of arsenic is added, which disposes it to run into spherical drops. When melted, it is poured into a cylinder whose circumference is pierced with holes. The lead streaming through the holes, soon divides into drops which fall into water, where they congeal. They are not all spherical; therefore, those that are must be separated, which is done by an ingenious contrivance. The whole is sifted on the upper end of a long smooth inclined plane, and the grains roll down to the lower end. But the pear-like shape of the bad grains makes them roll down irregularly, and they waddle as it were to a side; while the round ones run straight down, and are afterwards sorted into sizes by sieves. The manufacturers of the patent shot have fixed their furnace, for melting the metal, at the top of a tower 100 feet high, and procure a much greater number of spherical grains, by letting the melted lead fall into water from this height, as the shot is gradually cooled before it reaches the water.

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*Safety from speed in Skating.*—A person may skate with great rapidity over ice which would not support his weight if he moved over it more slowly. This arises from the fact, that time is requisite for producing the fracture of the ice: as soon as the weight of the skater begins to act on any point, the ice, supported by the water, bends slowly under him; but if the skater's velocity is considerable, he has passed off from the spot which was loaded before the bending has reached the point which would cause the ice to break.

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If hot water be poured into a glass jar of cold water, it will remain on the *surface;* but if cold water be poured upon hot water, it will sink to the *bottom* of the vessel. This experiment may be rendered more obvious by colouring that portion of the water which is poured in. The design of this experiment is to show the change of the specific gravity of the *same* body, merely by the agency of caloric.

## INSTITUTIONS.

*At the London Mechanic's Institution*, after the lecture by Mr. Naydon on the Fine Arts, on the 20th instant, it was announced that a Drawing class would be formed under the superintendence of a gentleman of talent, and a preliminary meeting was called for the 23rd instant. The meeting was held accordingly, when it was determined to request Mr. Haydon to superintend the class, which it was understood he would do on receiving a very slight remuneration for his services. The members who then intimated their willingness to form the class, arranged that the subscription should be *Five Shillings* per Quarter, which, if the class consisted of Fifty members, it was expected would be sufficient to cover all expenses.

### LECTURES DURING THE WEEK.

*London Institution*, Finsbury Circus.—Monday evening, Jan. 30, at seven o'clock, Dr. Ritchie, on Electricity.—Thursday afternoon, Feb. 2, at one, Mr. Sheridan Knowles, on the Drama.

*London Mechanics' Institution*, Southampton-buildings, Chancery-lane. — Wednesday, Feb. 1, at half-past eight, T. J. Searle, esq., on the Drama.—Friday, 3, Dr. Birkbeck, on Osteology.

*Aldersgate-street Institution*—Wednesday, Feb. 1, at half-past eight, Dr. Trueman, on Respiration.

*Western Literary and Scientific Institution*, 47, Leicester-square.—Thursday, Feb 2, at half-past eight, Mr. Sheridan Knowles, on the Drama.

*Islington Literary and Scientific Society*.—Friday, Feb. 3, at eight o'clock, an Essay and Discussion.

*Poplar Institution*.—Tuesday, Jan. 1., G. Francis, esq., on Botany.

*Mutual Institution Society*.—Southampton Coffee-House, Chancery-lane, at half-past eight, Essay on the Trinity.

### QUERIES.

*Varnish for Balloons.*—Doubtless some of your intelligent correspondents can inform me how to make the best and cheapest varnish for balloons—also if there be any particular kind of silk to be used.

G. H. M.

*Sponge.*—What is the specific gravity of dry sponge.

S. T. C.

### TO CORRESPONDENTS.

"Hennicus." The fact is so well known that it is unnecessary we should insert his communication.

"J. C." has been anticipated, as he will see by referring to No. 11.

"M. V." Next week.

We cannot answer the questions of "B." unless he writes more fully upon the subject. From his note we cannot exactly understand what he requires to know—particularly by his second query.

"Mr. Puttick's" letter shall not be overlooked.

All communications for insertion in the "Penny Mechanic," should be addressed "to the Editor," at the Publishers. Some of our correspondents have directed their letters *to the Publisher*, by which means they might have been delayed.

Correspondents who have not been answered, may consider their communication accepted.

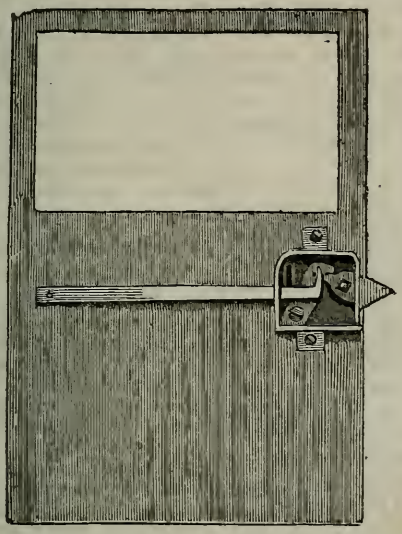
London: Printed at the Holloway Press, by D. A. Doudney; published by Berger, Holywell-street, Strand; and may be had of all Booksellers.

# THE PENNY MECHANIC.

A MAGAZINE OF THE ARTS AND SCIENCES.

No. XV.] FEB. 4, 1837. Vol. I.

PATTERSON'S CARRIAGE LOCK.



GAS COOKING APPARATUS.

Holloway Press: D. A. Doudney.

## GAS COOKING APPARATUS.

The practicability of applying gas to other purposes than that of merely affording light, has been frequently discussed; and the great heat gas gives out during combustion, rendered it evidently well calculated to be employed in the preparation of food. A gentleman, of the name of Hicks, in 1831, took out a patent for cooking by gas; and however strange it may appear to many persons, we can assure them we never enjoyed a mutton chop more than when we partook of one prepared in this manner. In some parts of the country gas is employed at taverns for the purpose of cooking; but the patent is very little used in the metropolis.

On the front page we give an engraving of the apparatus. C is a service gas-pipe, supposed to lead from the ordinary street main. D is a smaller pipe, furnished with a stop-cock, leading from C, and passing up through the dresser or table B, to a circular burner marked E, which emits an annular-formed flame, through a fissure cut entirely round the outer surface of the ring. F is an upright spit, rising upwards from the top of the main stem of the pipe D, through the centre of the annular burner, and on this spit the meat to be cooked is placed. G is a small dish at the bottom of the spit, to catch the dripping and gravy, and furnished with a small spout to carry it into a basin, which may stand on the dresser for that purpose, if required. H is a conical metal hood, or cover, open at the top, and suspended over a pulley by a balance weight from the top of the ceiling. The conical hood H being raised, the meat is spitted, and the gas lighted, when the said hood H is lowered over the meat, and the operation of cooking begins; the vapour which rises from the meat escapes at the open top of the cone, and being collected, may be made to escape into the flue of the kitchen chimney. O P is a contrivance for basting. O is a small colander, a piece of metal pierced with holes; and P is a sort of shallow funnel to conduct the dripping into the colander. The dripping is taken from the basin with a spoon, and poured into P, whence it runs into the colander, and is thence distributed over the meat through the holes pierced for that purpose.

It may, perhaps, be supposed that the odour of the gas would make the meat taste unpleasant. This, however, is not the case, at least as far as our experience will allow us to state, and we know gentlemen who have dined where the dinner has been cooked entirely by gas, and they expressed no dissatisfaction, but, on the contrary, stated the meats were cooked exceedingly well. We are therefore rather surprised that the cleanliness and economy of the invention has not obtained for it more extensive patronage. It might be used with great advantage in families, particularly where gas is laid on in gentlemen's houses.

## CARRIAGE DOOR LOCKS.

*To the Editor of the* Penny Mechanic.

Sir,—Probably you may recollect the accident which occurred to one of Lord Barrington's daughters about two years since; the young lady lost her life by falling out of the carriage. It is *supposed* she had opened the carriage door in playing with the handle of the lock. A short time after the accident I invented a lock (the model of which I have enclosed), for the prevention of similar accidents. It appears to me the principle of the lock is adapted for public conveyances on account of the impossibility of the door opening by accident. We, in our walks through town, frequently see the door of a hackney-coach fly open, and not altogether from the insecurity of the lock, but from the neglect of the person who shuts the door in not turning the handle. To obviate this as far as possible, I take the liberty of proposing my lock, if you should consider it worth a place in your excellent Magazine. Before the carriage-door can be opened, the slide which is fixed on the head of the door must be drawn from the lock, to remove a tumbler which holds the bolt, and prevents its turning till free of the notch. Now it is clear that no accident could occur from the accidental opening of the door by the adoption of this lock, unless it was through the carelessness of the attendant or coachman. I have sent you the above account, believing it might interest some of your numerous readers.

From your obedient servant,

G. A. Patterson.

3, *Rosoman-street, Clerkenwell.*

DESCRIPTION OF THE ENGRAVINGS.

Fig. I. represents the appearance of the lock on the inside of a carriage door. Fig. II. shows the condition of the lock when the door is closed.

The invention above described appears to us well calculated to effect the object intended. The contrivance is extremely simple, and if generally adopted would be the means of preventing many of the accidents that frequently occur, either from carelessness or accident, when the door of a stage-coach, or a family carriage, is left unlocked.

## HILL'S ROTARY PRINTING MACHINE.

*To the Editor of the Penny Mechanic.*

SIR,—About two years ago, when turning my attention to the machines then in use, a plan struck me of affixing the type to a cylinder, and causing it to revolve; since which time I have seen in the list of patents a notice of one granted to Mr. R. Hill; and in the Repertory, or London Journal, I forget exactly which, I saw a plate, containing a view of his machine, as also the specification; but I took it to be merely an improvement of the common machine; and the specification being long I did not take the trouble to read it. I was not aware that it was by fixing the type on the cylinder, till I read the short but clear, account in your work. I will now state the reasons which, two years ago, struck me as bars to its utility, and which will now, in my idea, prevent its use, though brought before the public, viz.—

1. The wedge-like form of the type will render it more difficult to cast. And the wedged form must commence from the very face of the letter.
2. That only one sized press could be used; or, that for every sized press different type must be had, thereby incurring great expense.
3. That the type could not be used with a common press without the inconvenience of wedged leads.
4. The compositors' work would be more difficult.
5. That the advantages gained would fall far short of the disadvantages caused by its use, as a slight consideration of the three first objections will show.

There are many minor disadvantages, but the above I consider as the chief. It may be proper to state that my plan for affixing the type to the cylinder was somewhat different to the one proposed by Mr. Hill. My plan was to have the type cast with a projection on one side and the usual nick on the other, but rather deeper, and into which the projection would fit when the type was composed.

I remain, Sir, yours, &c.,

*Jan.* 18, 1837. C. D. T.

## SHIPWRECKS.

NO. II.

*To the Editor of the* PENNY MECHANIC.

SIR,—If we consider the perpendicular cases, described in my letter in No. XI., as cylinders, we can easily conceive the possibility of these cylinders being each filled with two semi-cylinders; and we may imagine that these semi-cylinders are each cut by perpendicular planes; which planes, when the semi-cylinder is laid horizontally on deck, will form the deck of the semi-cylinder; this will be the first part of a new Life and Cargo-saving Boat. The stern and head of this boat are to be perpendicular planes, with three holes bored through them—one at the bottom, and one at each side, immediately under the deck of the boat. The stowage of these boats is each to consist of internal semi-cylinders, the outer part of which will coincide with the inner part of the C. S. Boat. These cases, for goods, provisions, &c., may be of any given length, from one foot to ten or twenty, according to the size of the vessel, and the nature, size, and quantity of goods in them. In the top of each of these cases there must be a cover, of a circular shape, the diameter of which will be one inch less than the diameter of the case. The receptacle for this cover must be a female screw, and the cover must be a male screw. It is to be screwed in by passing a lever through two eye-bolts, in the top itself, and these eye-bolts are to be made with joints, to stand up perpendicularly when wanted; and when the cover is screwed home the eye-bolts are to fall down, and all are to be flush with the deck.

In right lines with the holes in the ends of the boat, through each case or bale (as described), there must be holes of greater diameter, through these holes circular tubes must pass, and the inside diameter of each tube must be equal to the diameter of the holes at the ends. The head and cutwater, the stem and stern

part of this boat, must be of copper, cast or sheet iron, each forming either a semi-globe or the quarter of a globe, with six inches of an end to go immediately over the bow and stern of the boat.

Securing the whole. In the head and stern, horizontal tubes, as described above, must be passed. Then, through all, pass iron, cast metal, or copper rods, the head of each rod being foremost; and let these be secured by nuts and firmly screwed on at the stern.

The stability of this boat will be increased by laying a similar boat parallel to it; and over and under these boats, at convenient distances, pass strong bars of iron, which bars must go over the thwarts of the boats, and at right angles with the decks. These bars having holes with female screws in them, they can be secured by strong bolts. And thus a boat, on this entirely new construction, can be instantly (if previously prepared) got overboard.

The advantages of such boats and of such arrangements must be obvious. Each compartment in the boat being numbered, its contents will be known; and to get at these things nothing is to be done but to unscrew the top of the compartment. For a double boat like this, I conceive there is no necessity for a keel. But, if double boats should be objected to, keels can be put to single boats by means of tubes passing perpendicularly through the internal compartments in them; and all these tubes should be water-proof. The keels being of wood, holes should be bored in them, in a line with the perpendicular tubes; and in the under part of the keels nuts should be counter-sunk, then by bolts, with male screws on their euds, secure the keel, and, so far, all is right. The method of preparing the horizontal railings instantly, and of giving buoyancy to the boat, I will speak of (for the sake of precision) as if the boat were flat-bottomed and straight-sided. Parallel to the sides, and coinciding with them, I would sink perpendicular tubes of cast iron or gun-metal; six or four inches of the top of each of these tubes should be a ferrule-screw; and in this ferrule-screw I would insert my stancheon, to half the depth of the screw, at which place a joint should be that would allow the stancheon to fold down, and the end to be secured with a rope-yarn, to a small eye-bolt on the boat's deck. When the boat will be hoisted up, and laid on the upper deck of the ship, or suspended by tackle from the yards, the stancheons are to be erected, and three inches above the joist are to be screwed home; then, by man-ropes, the stancheons are to be set up.

I remain, Sir, your obdient servant,

M. Rough.

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Some Members of the *London Mechanics' Institution*, have for some time formed a class for the investigation of the truth and utility of the science of Phrenology. They have lately prevailed upon that most interesting lecturer, Dr. Epps, to deliver a lecture on the science, in the theatre of the Institution, on Thursday Evening, the 9th instant. A small sum will be charged for admittance, for the purpose of raising a fund to be expended in the purchase of such casts, &c. as are necessary to illustrate Phrenology, in order that the studies of those Members of the Institution, who may be desirous of examining the validity of the Phrenological Doctrines, may be facilitated. It is with pleasure, therefore, that we render our Magazine the medium of invitation, to all who may feel interested in the subject. We trust that many may avail themselves of the proffered opportunity, to assist in advancing the cause of truth, by placing the means of setting the validity of a science, which if correct will melitate most effectively against the evils that afflict humanity, within the reach of so many sincere searchers after truth, as must necessarily be included in such a numerous body, as the Members of the London Mechanics' Institution.

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## MECHANICS' LIBRARY.

*The Education of the Body.—An Address to the Working Classes.*—By Charles Bray. Effingham Wilson.

We have more sound useful information in this very neatly printed pamphlet for sixpence, than can be obtained from many volumes published at a dozen times the price. The education of the body is a subject that well deserves attention, more particularly from that class of persons, who in consequence of the nature of their employments are often afflicted with diseases, which a little knowledge of the structure of their bodies would enable them in a great measure to prevent if not to cure. The writer after making a few remarks upon the question "What is meant by Education," proceeds to describe briefly but perspicuously the structure and functions of the skin, lungs, and stomach; the importance of exercise—the action of the brain and nervous system—and concludes with some sensible observations on Moral and Intellectual Education. From the chapter on "the Lungs," we take the following extract:

"Those who are confined in factories or workshops in any numbers, should get all the exercise in the open air that they can. for to the neglect of this and

the consequent want of pure air, is owing the pale faces, langour, weakness, and susceptibility to chest affections so generally observable in operatives, and which make such a difference between them and those who work out of doors.

"Great mischief to the health will arise from too many sleeping in one apartment; almost any sacrifice should be made to prevent this.

"A fire in a small bed-room is unwholesome, and indeed dangerous, because it consumes more vital air than a number of persons together would by breathing. A charcoal fire is particularly dangerous in a bed-room, and injurious everywhere, because it not only takes away large portions of the oxygen, but also generates a great quantity of fixed air, or carbonic acid gas, which is positively poisonous. Many persons rise in the morning with head-ache and great languor and debility, and this is frequently owing to deficient ventilation in their bed-rooms. Bed curtains are very injurious things when drawn close round a bed.

"A room in which any number have assembled, should never be occupied again until it has been well ventilated, by having its windows and doors thrown open; this should be particularly observed in bed-rooms.

"The ill effects of deficient ventilation can scarcely be calculated, and the suffering resulting from this neglect, in the shape of established delicate health, head-ache, consumption, fever, and various kinds of nervous complaints, is enormous.

"For those who have weak lungs, this care is especially necessary. Considering also the extent of the surface of the lungs, and the quantity of air that is admitted to them, at every inspiration, frequent change of temperature must be very hurtful. In order to lessen the ill effects of this, upon coming suddenly into the cold air, it has been found a good plan to breathe through a handkerchief or something put before the mouth. Dr. Combe says, 'the cold air thus becomes partially heated, and deprived of its moisture in passing through such a medium, and the protection thus afforded is so marked, that few who have tried the precaution will ever afterwards neglect it.'"

*The Connection of the Physical Sciences.* —By Mary Somerville. Third Edition.

The book before us is one well calculated to stimulate thought and enquiry. Although written by a woman, the Connection of the Physical Sciences is evidently the production of a mind equal in all respects, and in many, superior to that of a man of high intellectual acquirements. Mrs. Somerville is already well known to the scientific reader, by her admirable work on the Mechanism of the Heavens. She is effecting for Physical Science, what the Miss Edworths have done for Moral Science, divesting it of its technicalities, and making it pleasing to, and easy to be understood by all classes of society. The effects of this it is gratifying to contemplate. The book has been eagerly sought after; this is evident from a third edition having been so soon called for, and thus a numerous class of persons, who would be unable to comprehend the sublime truths stated in the work, unless explained in a familiar manner, are enabled, by her exertions, to do so. Mrs. Somerville, like Dr. Arnott, but unlike some who call themselves philosophers, does not wish persons to remain ignorant of science, because they do not happen to have received a mathematical education. As a proof of this we quote the following paragraph.

Knowledge for all.—"A complete acquaintance with physical astronomy can be attained by those only who are well versed in the higher branches of mathematical and mechanical science, and they alone can appreciate the extreme beauty of the results, and of the means by which these results are obtained. It is nevertheless true, that a sufficient skill in analysis to follow the general outline,—to see the mutual dependence of the different parts of the system, and to comprehend by what means the most extraordinary conclusions have been arrived at,—is within the reach of many who shrink from the task, appalled by difficulties, which, perhaps, are not more formidable than those incident to the study of the elements of every branch of knowledge. There is a wide distinction between the degree of mathematical acquirement necessary for

making discoveries, and that which is requisite for understanding what others have done."

The best means of making our readers acquainted with the character of the work, will be to extract a few passages; this we do, without observing any particular order, but merely giving a few that we marked when reading the book.

Immensity of the Universe.—"The heavens afford the most sublime subject of study which can be derived from science. The magnitude and splendour of the objects, the inconceivable rapidity with which they move, and the enormous distances between them, impress the mind with some notion of the energy that maintains them in their motions, with a durability to which we can see no limit. Equally conspicuous is the goodness of the great First Cause, in having endowed man with faculties, by which he can not only appreciate the magnificence of His works, but trace, with precision, the operation of His laws, use the globe he inhabits as a base wherewith to measure the magnitude and distance of the sun and planets, and make the diameter of the earth's orbit the first step of a scale by which he may ascend to the starry firmament. Such pursuits, while they ennoble the mind, at the same time inculcate humility, by showing that there is a barrier which no energy, mental or physical, can ever enable us to pass: that, however profoundly we may penetrate the depths of space, there still remain innumerable systems, compared with which, those apparently so vast must dwindle into insignificance, or even become invisible; and that not only man, but the globe he inhabits,—nay, the whole system of which it forms so small a part,—might be annihilated, and its extinction be unperceived in the immensity of creation.

"Far as the earth seems to be from the sun, Uranus is no less than nineteen times farther. Situate on the verge of the system, the sun must appear to it not much larger than Venus does to us. The earth cannot even be visible as a telescopic object to a body so remote. Yet man, the inhabitant of the earth, soars beyond the vast dimensions of the system to which his planet belongs, and assumes the diameter of its orbit as the base of a triangle, whose apex extends to the stars. Sublime as the idea is, this assumption proves ineffectual, for the apparent places of the fixed stars are not sensibly changed by the earth's annual revolution. With the aid derived from the refinements of modern astronomy, and of the most perfect instruments, it is still a matter of doubt, whether a sensible parallax has been detected even in the nearest of these remote suns. If a fixed star had the parallax of one second, it would be 215,789 times farther from the sun than the earth is. At such a distance not only the terrestrial orbit shrinks to a point, but the whole solar system seen in the focus of the most powerful telescope, might be eclipsed by the thickness of a spider's thread. Light flying at the rate of 200,000 miles in a second, would take three years and seven days to travel over that space. One of the nearest stars may therefore have been kindled or extinguished more than three years, before we could have been aware of so mighty an event. But this distance must be small, when compared with that of the most remote of the bodies which are visible in the heavens. The fixed stars are undoubtedly luminous like the sun; it is therefore probable that they are not nearer to one another than the sun is to the nearest of them. In the milky way and the other starry nebulæ, some of the stars that seem to us to be close to others, may be far behind them in the boundless depth of space; nay, may be rationally supposed to be situate many thousand times farther off. Light would therefore require thousands of years to come to the earth from those myriads of suns, of which our own is but 'the dim and remote companion.'"

## RAILWAYS.

### NO. III.

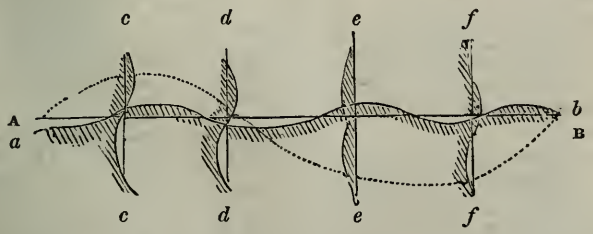
Supposing that the question relative to the plan on which the railway is to be constructed, has been determined in favour of the system of levels, connected by steep inclined planes; the next thing necessary to be done is to trace a line for the railway, upon a survey of the country, or map, in which we proceed in the following manner:

Considering as Geologists do, that the dry land is only that portion of the

earth which is sufficiently elevated to rise above the circumjacent waters of the ocean; we should naturally suppose that the general face of the country would rise regularly from the sea shore, to the central parts; in this opinion we are confirmed by the tendency of all rivers to flow towards the sea; sometimes descending many feet perpendicularly, as in the case of a waterfall. Now it also follows, that as rivers are nothing more than the drainage of the country through which they flow, they will, in all cases, occupy the lowest land in the neighbourhood, on account of all water finding the lowest level, thu if we find two rivers, whose direction is nearly parallel to each other, we may consider that we have some high land between them. Also, when the course of a river is very circuitous, we may consider that the country through which it flows is hilly. And when we find that two rivers commence near the same place, but proceed in two opposite directions towards the sea, that then we have rising land from the sea, to that point in the course of each river. The same remarks may be applied to tributaries, and their tributaries in like manner. With the assistance of these remarks, and a *good* map, such as the Ordinance map, (the finest map that was ever published), Walker's British Atlas, or the maps published under the superintendance of the Society for the Diffusion of Useful Knowledge, some idea may be formed as to the course we should follow to obtain a line of gradients that may suit our road. In these maps which I have mentioned, all the rivers, ridges of high hills, brooks, &c. are accurately marked.

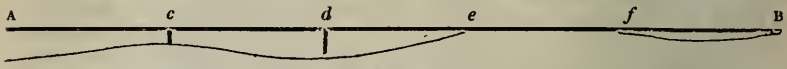
Thus the situation of the two places having been considered as to their probable difference of level, the country between should next be considered, and if it is supposed to consist of high land, the lowest level will be indicated by the drainage, and if hilly, a gap in the chain may be found through which we can conduct our line. Should the intervening land be marshy, and have high land at the back, the best way would be to cross the marsh with a level embankment, and to ascend to a sufficient height to obtain a long level by means of a steep inclined plane, in preference to ascending by means of a long inclined plane with a small inclination per mile, as I have before described. In this manner we ascertain the general nature of the country through which we have to pass, but as the land is generally undulating, the only way to find the best levels is by means of the leveling instrument in the field, with the assistance of judgment, and the eye, or when any particular level is required, with the least cutting and embanking, the line which that line would follow on a map, is found by cross leveling, which is practised in the following way.

Suppose that it was necessary to find a level or plane with the least cutting and embanking between the two places, A B in the following figure. Draw the line A B, which is the principal line of levels, and the lines, *cc*, *dd* *a*, and *ff* lines, taken at right angles,




with the principal line upon which levels are also taken, the line *a b*, is the section of the country, taken upon the line A B, the other undulating lines represent the sections on the lines, at right angles. Now it will appear by the above diagram, that the amount of cutting would greatly exceed the embankments, therefore, we may take the line of lowest levels indicated in the

cross sections, as we have done in the case of the dotted line in the diagram. Now if we take a pair of compasses, and measure off the different levels, one section will represent the following line, where A B represent the level line, as in the first diagram, and the small letters *c d e f*, the places where the




dotted line crosses the other lines, marked with the same letters, and it will be perceived that the difference of the levels is nothing like so great as in the first instance, and consequently there would be much less cutting and embanking, than there would be in the first section.

Having obtained a line that contains the least difference of level, as I have just described, it must be further reduced by means of embanking and cutting. The base of a railway, is the breadth of the top of an embankment, or the bottom of a cutting, exclusive of the drains; and varies from fifteen to thirty feet; embankments and cuttings have their sides sloped, at about the rate of one foot perpendicular, to one foot six horizontal. The cuttings have a drain on each side, about two feet deep; and the embankments a brick drain at right angles to their length, where occasion may require. Where a ridge of high land intersects the intended line of railway, that cannot be otherwise avoided, tunneling is resorted to, and is approached by means of a cutting at each end. Tunnels should always be avoided where it is possible, both on account of the expense of constructing them, and the public feeling which is not greatly in favour of them; persons connected with these works, would as leave be under ground as above, but this is not the case with every body. Where the railway crosses a brook or stream, a bridge must be constructed over it, for the railway to pass, and where it intersects a turnpike-road, an arch is constructed either over or under the road, as it is exceedingly inconvenient that they should cross upon the same level. In my next I shall describe the rails crossing turnings, &c.

E. F. W.

## INSTITUTIONS.

LECTURES DURING THE WEEK.

*London Institution*, Finsbury Circus.—Monday evening, Feb. 6, at seven o'clock, Dr. Ritchie, on Magnetism.—Thursday afternoon, Feb. 9, at one, R. Adams, esq, on Acoustics.

*London Mechanics' Institution*, Southampton-buildings, Chancery-lane. — Wednesday, Feb. 8, at half-past eight, T. J. Searle, esq., on the Drama.—Friday, 10, J. Cromwell, esq., on the Antiquities of the British Isles.

*Aldersgate-street Institution*—Wednesday, Feb. 8, at half-past eight, Dr. Trueman, on the Voice.

*Western Literary and Scientific Institution*, 47, Leicester-square.—Thursday, Feb 9, at half-past eight, Mr. Sheridan Knowles, on the Drama.

*Poplar Institution*.—Tuesday, Feb. 7., G. Francis, esq., on Botany.

## A QUERY.

VITALITY OF SEEDS.

"Jesse" in his Gleanings in Natural History, states that earth brought up from a depth of 360 feet below the surface, had plants spontaneously shoot up from it.

Is not this a proof that plants have existed in the different strata, and that the seeds which germinate are those of plants that have been prevented doing so previously, from some natural cause?

S.

## TO CORRESPONDENTS.

"J. J. Ritches." The best way would be to get some one who would not object to risk a little money on the invention to advance sufficient to obtain the Patent.—The diagram and letter shall be attended to.

We differ entirely from "Christian-Hackney," respecting the paper to which he alludes.

"W." we think, intended to deceive us. Why did he not say his communication was extracted from the periodical in which it appeared a fortnight ago?

"J. W. Ritchie's" paper and diagram of a safety steam boiler shall be attended to.

"Mr. Wivell's" note, dated the 17th ult., was not received until the 31st. We will write to him in a day or two on the subject.

The press of other matter has prevented our continuing "the Steam Engine." We shall now however do so regularly.

The communications of those Correspondents we have not answered separately, are accepted.

Rooks for Review and Letters for the Editor, should be sent as early in the week as possible.

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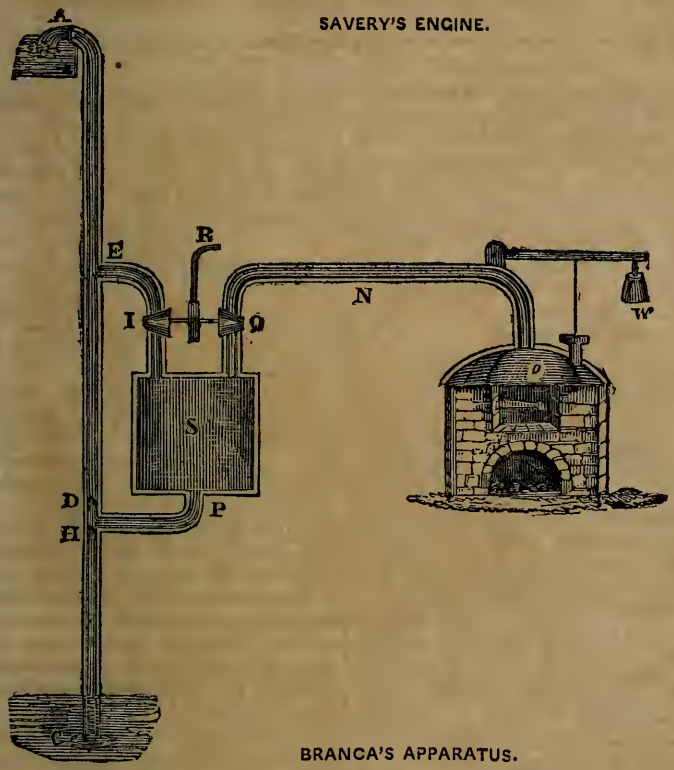
# THE PENNY MECHANIC.

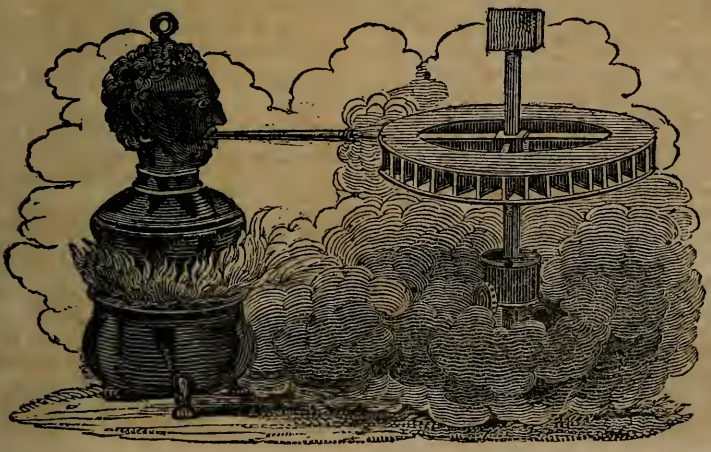
A MAGAZINE OF THE ARTS AND SCIENCES.

No. XVI.] FEB. 11, 1837. Vol. I.

SAVERY'S ENGINE.




BRANCA'S APPARATUS.





Holloway Press: D. A. Doudney.

## THE STEAM ENGINE.

### NO. VI.

The steam engine constructed by Captain Savery, and described in our tenth Number, may be said to be the first that was ever made applicable for a really useful purpose. It did not however accomplish all that was expected. Instead of raising water thirty-four feet high, it was found that the pressure of the atmosphere would not raise it above twenty-seven or twenty-eight feet; and this arose in consequence of the resistance from the vapour formed within the vessels where the steam was condensed, (v v in the engraving of Savery's engine), water is converted into vapour at a very low temperature when in vacuo, and it therefore formed in considerable quantities in the steam vessels, after the steam had been condensed, and a vacuum thereby produced. Another disadvantage was the great danger attending the use of Savery's engine. The high pressure of the steam was occasionally so great that the pipes and condensing vessels were not strong enough to resist it,—they burst, and the most disasterous consequenees of course ensued. There was also an enormous quantity of fuel required in order to work the engine with effect. The water was often raised to a temperature of 267°, which of course tended to destroy the apparatus; it was therefore frequently obliged to be renewed. The vessels in which the steam was condensed also had to be raised to the boiling point before fresh steam could remain in it, without being condensed before the time required; this occasioned a great waste of steam, and when it was admitted to press on the surface of the water a great portion of it was also condensed. Notwithstanding all these disadvantages, however, Savery's engines were found far preferable to the ordinary pumps for raising water from mines, and were accordingly pretty generally used.

Savery made an important addition to the means of preventing aceidents with steam engines, by inventing what is termed the *gauge pipe*, the use of which is to determine how much water there is at any time in the boiler. If the end of the pipe inside be under the water, on turning the cock of course water will be forced up, by the pressure of the steam upon the surface of the water; but if the pipe be above the water, steam only will then escape, and by this means, therefore, the engineers can learn when it is necessary that the boiler should be replenished. In modern engines there are two gauge pipes; one descends as low into the boiler as it is safe ever to permit the water to be; the other pipe terminates above the water; when, therefore, on both the cocks being turned, steam escapes from one and water from the other, the boiler is in proper order, but if steam escapes from both, it shows that the boiler should have a fresh supply of water,—if water escapes from both, there is too much.

Besides this improvement, it was Savery who first suggested the plan of ascertaining the power of steam engines by reference to *horse power*. A horse can raise a certain quantity of water daily, working eight hours a day; an engine capable of performing the same work, in the same time, is said to be of one-horse power, and so in proportion. It is evident, however, that such an engine ought to be called one of *three*-horse power, since it can work the whole twenty-four hours of the day, while a horse is only supposed to work eight.

As the engraving we gave of Savery's engine complete, was rather complex, in ease it should not have been thoroughly understood, we give in the front page a section of one with a single condenser, in which the action can be more clearly observed.

This apparatus consisted of a boiler o, furnished with a safety valve m, acting by means of a weight w at the end of the lever. The steam vessel s, into which the steam was made to pass through the pipe n, was connected with the well c by the suction-pipe h p, and when water was to be raised, the vessel s was filled with steam, which completely expelled the air. The communication with the boiler was then closed by shutting the valve q, and the steam in the vessel becoming condensed, a vacuum was formed, into which the water rushed from the well by the pressure of the atmosphere on

its surface. The handle R is used to give motion to the double valve I and Q, the former being intended to admit condensing water from the pipe A D, while the latter alternately opens and shuts the steam communication. In this form of the apparatus the inventor was seldom able to raise water more than thirty feet, and when a greater altitude was required, it was effected by the impelling force of the steam. This was accomplished by the ascending pipe A D, which was sometimes carried sixty feet higher than the steam vessel S. After condensing the steam, and filling the vessel S with water, a new supply of steam was introduced, which, pressing on the surface of the water, drove it up the pipe D; but, as we have just stated, it will be evident that this operation must be sometimes very dangerous, as the pressure on the internal surface of the boiler must be in proportion to the height of the column of water raised by the elasticity of the steam.

If we were treating of the improvements of the steam engine according to their importance, we should properly begin with those of our own time, and trace them backward to the time of Hero; but as we are endeavouring to shew the progressive steps by which this stupendous machine has been brought to its present state of perfection, every improvement or suggestion that tended to bring about this result, is entitled to due consideration. It is from this circumstance that we notice the "fire wheel" of Amontons, a Frenchman, which, although too complicated and liable to derangement for any practical purpose, was yet constructed with considerable ingenuity. He proposed rarifying the air in a number of cells, on the edge of a wheel, and by permitting the expanded air to press on the surface of water, situate in a series of cells immediately above those containing the air, he proposed forcing the water into the upper part of the wheel, by this means changing its centre of gravity, and giving it a rotatory motion. Amontons expected to gain immense power by this machine, at very trifling expense; but however well the model may have worked, the machinery was found very inefficient on a large scale. The engine does not appear either to have originated any other, or to have been improved upon as the inventor's countryman, Papiu's, was.

The second engraving on the front page is a representation of Branca's apparatus, which we did not illustrate at the time it was described. The body of the figure is the boiler, and the steam is allowed to escape through the mouth. It is partially condensed by the atmosphere, and the particles of water striking against the wheel, in front of the figure, give motion to it, which was communicated to other machinery and thus made to answer a useful purpose.

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## WARMING ROOMS,

### ON AN IMPROVED METHOD.

*To the Editor of the Penny Mechanic.*

SIR,—I was lately very much pleased and gratified, in visiting the City of London Free School, situate in Honcy Lane Market, near the Guildhall, to observe a very effectual method of warming all the rooms in the house by means of hot water. An explanation of this novel and ingenious mode may not prove altogether unworthy of your columns.

In the cellar or bottom part of the house a large fire was erected, and round this fire were a quantity of pipes about an inch in diameter, forming a kind of barricade round the fire-place. From this range of pipes, other pipes were grafted, which were conveyed to all parts of the house, and laid behind the wainscoting of the rooms, which were made of thin iron, wrought like net work. When the hot water was poured in at one portion of the pipe, it was kept continually boiling by the fire which it enclosed, and the steam passing through all the different pipes which were connected with the rooms, threw out a pleasant and equal heat which diffused itself through all the apartments, thus precluding the necessity of having fires. The steam that was thus generated, after being condensed into water, returned again to the reservoir at the bottom of the house, where it was again formed into steam and passed through the different rooms

as before, thus forming a continual round.

I should think this mode of heating apartments would be peculiarly adapted for public rooms, churches, &c., though in private houses I should prefer a *snug fire-side.*

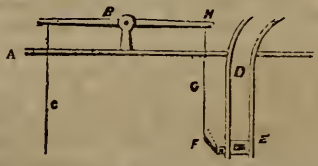
I am, Sir,
Your most obedient Servant,
IOTA.

[The London Mechanics' Institution, and many public buildings are warmed on a similar principle.]—ED. P. M.

### THE STEAM BOILER.

*To the Editor of the Penny Mechanic.*

SIR,—I have just been looking over the plan for improvement in the Steam Boiler by Mr. T. King, and I think that that gentleman's arrangement of the water-valve will not tend to ameliorate the bad qualities of Mr. Douglas' invention in so great a degree as could be wished, if indeed at all. For as the heat is continued, and the expansive force of the steam increased, it will press on the surface of the water (which having no other way of escape) will be forced up the pipe F (See Penny Mechanic Fig. 1. p. 65,) and produce the same effects as Mr. King states would be the result if the pipe F were above the surface of the water, viz. "force up the water-valve, and thereby force the float under water, and render it totally useless." To remedy this I would propose the pipe F should be above the surface of the water, having a cock connected with the float as seen in the following sketch.




A portion of boiler, B steelyard, (as in Mr. King's arrangement) C float rod, D pipe, from which water is to be conveyed from any convenient situation into the boiler to supply D, a cock therein which is to be opened by the handle F fixed to the rod G, at the other end of the steelyard. Now as the water is converted into steam, and the quantity consequently diminished the float will sink; the end H will be elevated, and with it the rod G, which movement will bring the handle F into the dotted position; turn the cock and supply the deficiency which has taken place in the boiler. I think the best form of a float should be that of an inverted basin, and the best material for its construction, copper.

If you deem the above hasty remarks worthy a place in your useful little work, the insertion will oblige

Your constant reader,
J. F. PUTTICH.

### CAPILLARY ATTRACTION.*

IMMERSE in a vessel of coloured water, one end of a glass tube whose bore is very small, and the liquid will be seen to rise in it and remain above the surface of that in the vessel, which phenomenon is owing to a property in the tube called *Capillary Attraction.* In tubes, whose bores are of different sizes the liquid will rise to different heights, it will rise one inch and remain at that altitude. In a tube whose bore is the fiftieth part of an inch in diameter, but in a tube the bore of which is half that diameter the liquid will rise to double that height, so that the elevation of fluids in capillary tubes, is in an inverse proportion to their internal diameter. It is upon the principle of capillary attraction that water will rise between two square plates of glass; and if they be joined on one side, and kept a little open on the other, the liquid will rise and remain at an unequal altitude, its surface forming a curve. Capillary suspension, also takes place in the adhesion of a drop of water to the side of a glass tube, &c., which evinces that the particles of water have a greater affinity for the particles of glass, than for those of water. The effect of capillary attraction, as exemplified in the above instances is very clear, but the cause of it is not satisfactorily known, the theories of philosophers upon this subject having been different; many affirm that the attraction is at that part of the tube forming a ring round the surface of the liquid in it; and others assert that it acts at the small rings of glass contiguous to the

* *Capillary* is taken from a Latin word signifying *hair;* hence, the bores of capillary tubes are very fine like a *hair.*

lower end of the tube; the former opinion seems the most probable, for in the latter case, the rings below the upper surface attract the liquid above them downwards, as much as they attract that below them upwards, consequently there would be no power to support the liquid.

Any liquid that has no attraction for glass, will not ascend in a capillary tube, above the surface of the liquid outside it, but on the contrary, remain below the surface.

The surface of water in a capillary tube is concave, but the surface of any liquid that has no attraction for the tube will be convex.

The ascent of water in sugar, chalk, sponge, &c., is caused by capillary attraction.

S. T. C.

## VENTILATING THE HOUSE OF COMMONS.

SHORTLY after the termination of the last session of Parliament, very extensive alterations in the existing House of Commons, with a view both to ventilation and improved transmission of sound, were commenced under the auspices of Dr. Reid of Edinburgh. In the first place a new ceiling of an entirely novel construction has been interposed between the ancient roof and the floor. The ceiling may be considered as divided into three portions, the centre from one end to the other being perfectly horizontal; the two other compartments are inclined planes, each making with the centre, an angle of about 120 degrees. Those portions of the ceiling which form inclined planes are glazed, while the centre is panelled, to aid in accomplishing the great purpose of ventilation. The side galleries, occupied solely by members, have had their floors materially altered, and an inclination has been given to the ceiling beneath them, which corresponds exactly with the inclination of the lateral compartments in the newly-constructed ceiling above. The strangers' gallery has been advanced and lowered, so that its front row is on a level with the members' side gallery, and altogether it is brought more within the body of the House, so that its back forms a much better reflector for sound than heretofore existed. The reporters' gallery has been similarly advanced. The floor of the House itself remains at its original level, but is entirely perforated with small holes in close proximity, in aid of the object of ventilation.

The works having been brought so far near completion as to warrant it, an experiment was made a short time back, with the House filled by men from the foot-guards.

Dr. Reid then proceeded to exhibit by means of a glass model on the table of the House, the operation of his plans. He stated that the main object which he had proposed to himself to achieve was to introduce imperceptibly a constant supply of fresh air, either cool or heated, as the state of the weather or the number of members in the House might require. He pointed out that a short distance beneath the former floor a second floor had been formed, in which were between 20 and 30 large apertures of about 18 inches in diameter. Through these apertures the cool or heated air was in the first instance admitted; and immediately over them were placed large platforms like tables, sustained by short feet, which had the effect of dispersing the great body of air which the large apertures admitted. The air then enters through perforations made in the actual floor of the House, consisting of the almost incredible number of 350,000. They are about the sixth of an inch in diameter on the surface of the floor, but expand downwards in order to prevent their being easily choked or becoming stopped. The egress of the vitiated air is provided for by means of each panel of the centre compartment of the ceiling being raised by blocks several inches above their styles; and it is drawn off by the action of a large circular shaft, which has been erected by Cotton-garden at a distance of about 20 feet from the eastern wall of the building, and constructed so as to contain at an elevation of 10 feet from the earth an exceedingly large coal-fire. The draft created by this shaft draws the air from the roof of the House down a smaller square shaft. The action of both shafts is regulated by dampers.

Dr. Reid tried several experiments, with a view to show the rapidity of circulation through the House:—He first caused the introduction of a smoke so dense that it was impossible to see five yards forwards. In about one minute and a half, by the action of the shaft, it was entirely expelled. He next introduced the odour of ether, which was strongly perceptible to every person present, and dispersed in an equally short space of time by the active but imperceptible introduction of heated air. In like manner was the scent of oranges raised and dispersed. It was reported that during the whole of the experiments the temperature varied only from 60 to 62

degrees, but Dr. Reid stated it was quite in his power to lower it to the condition of the outer atmosphere. The acoustics were then tried by speaking and reading in all parts of the House, and by various voices, and were pronounced by the gentlemen present to be at all points in the highest degree satisfactory. It ought, however, to be mentioned that there was an absence of that continued murmur or buz which characterises the sittings of the legitimate occupants of the House.

The expense of the alterations is estimated at about 12,000*l.*

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Heat of the Earth.—"The high temperature of mines, hot springs, and above all, the internal fires which have produced and do still occasion such devastation on our planet, indicate an augmentation of heat towards its centre. The increase of density, corresponding to the depth and the form of the spheroid, being what theory assigns to a fluid mass in rotation, concur to induce the idea that the temperature of the earth was originally so high as to reduce all the substances of which it is composed to a state of fusion, or of vapour, and that in the course of ages, it has cooled down to its present state; that it is still becoming colder, and that it will continue to do so, till the whole mass arrives at the temperature of the medium in which it is placed, or rather at a state of equilibrium between this temperature, the cooling power of its own radiation, and the heating effect of the sun's rays."

Comets.—"Only comets with retrograde motions can come into direct collision with the earth, and if the momentum were great the event might be fatal; but in general the substance of comets is so rare, that it is likely they would not do much harm if they were to impinge; and even then the mischief would probably be local, and the equilibrium soon restored, provided the nucleus were gaseous, or very small. It is, however, more probable that the earth would only be deflected a little from its course by the approach of a comet, without being touched by it. The comets that have come nearest to the earth were that of the year 837, which remained four days within less than 1,240,000 leagues from our orbit; that of 1770, which approached within about six times the distance of the moon. The celebrated comet of 1680 also came very near to us; and the comet whose period is $6\frac{3}{4}$ years was ten times nearer the earth in 1805 than in 1832, when it caused so much alarm. Comets in or near their perihelion move with prodigious velocity. That of 1680 appears to have gone half round the sun in ten hours and a half, moving at the rate of 880,000 miles an hour. If its enormous centrifugal force had ceased when passing its perihelion, it would have fallen to the sun in about three minutes, as it was then only 147,000 miles from his surface. A body of such tenuity as the comet, moving with such velocity, must have met with great resistance from the dense atmosphere of the sun, while passing so near his surface at its perihelion. The centrifugal force must consequently have been diminished, and the sun's attraction proportionally augmented, so that it must have come nearer to the sun in 1680 than in its preceding revolution, and would subsequently describe a smaller orbit. As this diminution of its orbit will be repeated at each revolution, the comet will infallibly end by falling on the surface of the sun, unless its course be changed by the disturbing influence of some large body in the unknown expanse of creation. Our ignorance of the actual density of the sun's atmosphere, of the density of the comet, and of the period of its revolution, renders it impossible to form any idea of the number of centuries which must elapse before this event takes places. But this is not the only comet threatened with such a catastrophe; Encke's, and that discovered by M. Biela, are both slowly tending to the same fate. By the resistance of the ether, they will perform each revolution nearer and nearer to the sun, till at last they will be precipitated on his surface. The same cause may affect the motions of the planets, and ultimately be the means of destroying the solar system. But, as Sir John Herschel observes, they could hardly all revolve in the same direction round the sun for so many ages without impressing a corresponding motion on the etherial fluid, which may preserve them from the accumulated effects of its resistance. Should this material fluid revolve about the sun like a vortex, it will accelerate

the revolutions of such comets as have direct motions, and retard those that have retrograde motions."

SOMERVILLE.

## TANNING.

THE process of tanning will furnish us with a striking illustration of the power of machinery in accelerating certain processes in which natural operations have a principal effect. The object of this art is to combine a certain principle called tanning with every particle of the skin to be tanned. This, in the ordinary process, is accomplished by allowing the skins to soak in pits containing a solution of tanning matter: they remain in the pits six, twelve, or eighteen months; and in some instances, (if the hides are very thick,) they are exposed to the operation for two years, or even during a longer period. This length of time is apparently required in order to allow the tanning matter to penetrate into the interior of a thick hide. The improved process consists in placing the hides with the solution of tan in close vessels, and then exhausting the air. The effect is to withdraw any air which may be contained in the pores of the hides, and to aid capillary attraction by the pressure of the atmosphere in forcing the tan into the interior of the skins. The effect of the additional force thus brought into action can be equal only to one atmosphere, but a further improvement can be made: the vessel containing the hides is, after exhaustion, filled up with a solution of tan; a small additional quantity is then injected with a forcing-pump. By these means any degree of pressure may be given which the containing vessel is capable of supporting; and it has been found that, by employing such a method, the thickest hides may be tanned in six weeks or two months.

The same process of injection might be applied to impregnate timber with tar, or any other substance capable of preserving it from decay; and if it were not too expensive, the deal floors of houses might thus be impregnated with alumine or other substances, which would render them much less liable to be accidentally set on fire. In some cases in might be useful to impregnate woods with resins, varnish, or oil; and wood saturated with oil might, in some instances, be usefully employed in machinery for giving a constant, but very minute supply of that fluid to iron or steel, against which it is worked. Some idea of the quantity of matter which can be injected into wood by great pressure, may be formed, from considering the fact stated by Mr. Scoresby, respecting an accident which occurred to a boat of one of our whaling ships. The harpoon having been struck into the fish, the whale in this instance, dived directly down, and carried the boat along with him. On returning to the surface the animal was killed, but the boat, instead of rising, was found suspended beneath the whale by the rope of the harpoon; and on drawing it up, every part of the wood was found to be so completely saturated with water as to sink immediately to the bottom.

*The Glazier's Diamond.*—The art of using the diamond for cutting glass has undergone, within a few years, a very important improvement. A glazier's apprentice, when using a diamond set in a conical ferrule, as was always the practice about twenty years since, found great difficulty in acquiring the art of using it with certainty; and, at the end of seven years' apprenticeship, many were found but indifferently skilled in its employment. This arose from the difficulty of finding the precise angle at which the diamond cuts, and of guiding it along the glass at the proper inclination when that angle is found. Almost the whole of the time consumed and of the glass destroyed in acquiring the art of cutting glass, may now be saved by the use of an improved tool. The gem is set in a small piece of squared brass with its edge nearly parallel to one side of the square. A person skilled in its use now files away the brass on one side until, by trial, he finds that the diamond will make a clean cut, when guided by keeping this edge pressed against a ruler. The diamond and its mounting are now attached to a stick like a pencil, by means of a swivel allowing a small angular motion. Thus, even the beginner at once applies the cutting edge at the proper angle, by pressing the side of the brass against the ruler; and even though the part he holds in his hand should deviate a little from the required angle, it communicates no irregularity to the position of the diamond, which rarely fails to do its office when thus employed.—*Babbage.*

*Employment of materials of little value.*—The skins used by the goldbeater are produced from the offal of animals. The hoofs of horses and cattle, and other horny refuse, are employed in the production of the prussiate of potash, that beautiful, yellow, crystallized salt, which is exhibited in the shops of some of our chemists. The worn-out saucepans and tin ware of our kitchens, when beyond the reach of the tinker's art, are not utterly worthless. We sometimes meet carts loaded with old

tin kettles and worn-out iron coal skuttles traversing our streets. These have not yet completed their useful course; the less corroded parts are cut into strips, punched with small holes, and varnished with a coarse black varnish for the use of the trunk-maker, who protects the edges and handles of his boxes with them; the remainder are conveyed to the manufacturing chemists in the outskirts of the town, who employ them in combination with pyroligneeus acid, in making black die for the use of calico printers.—*Babbage.*

## INSTITUTIONS.

*Mutual Instruction Society.*—This society, meeting at the Southampton Coffee House, Southampton Buildings, Chancery Lane, has been established nearly three years. The members meet every *Thursday* evening at half-past eight o'clock, when one of them reads an essay, or delivers his opinion extempory, on some question in metaphysics, history, theology, &c. A discussion ensues, in which every member is at liberty to take part if he pleases. By this means much valuable information is diffused, and a person may acquire the art of expressing his opinions to any number of individuals, without embarrassment. These, however, are not the only advantages offered by the society; it possesses a very good library, and many of the magazines are taken in regularly, which the members are permitted to take home to peruse.

Any of our readers who might wish to join the Society, can do so on applying to the Secretary at the place of meeting, any Thursday Evening. The Subscription is only *One Shilling and Sixpence* per Quarter.

### LECTURES DURING THE WEEK.

*London Institution*, Finsbury Circus.—Monday evening, Feb. 13, at seven o'clock, Dr. Ritchie, on Magnetism.—Thursday afternoon, Feb. 16, at one, R. Addams, esq, on Acoustics.

*London Mechanics' Institution*, Southampton-buildings, Chancery-lane. — Wednesday, Feb. 15, E. Cowper, esq., on Paper Making.—Friday, 17, T. J. Searle, esq., on the Drama, both at half-past eight.

*Aldersgate-street Institution*—Wednesday, Feb. 15, at half-past eight, T. J. Searle, esq., on the Drama.

*Islington Literary and Scientific Society.*—Thursday, Feb. 16, at eight, Dr. Trueman, on Digestion.

*Western Literary and Scientific Institution*, 47, Leicester-square.—Thursday, Feb 16, at half-past eight, Mr. Sheridan Knowles, on the Drama.

*Poplar Institution*, East India Road.—Tuesday, Feb. 14., W. Lukeing, esq., on Electricity, at eight o'clock.

*Society of Arts*, Adelphi.—Tuesday, Feb. 14, the Secretary, on the Metallingical History of Iron.

*Eastern Atheneum.* — Wednesday, Feb. 15, C. H. Purday, esq., on the Music of Various Nations with Vocal Illustrations, at eight.

## QUERIES.

"W. V." wishes to know which are the best treatises "upon Natural Philosophy, Mechanics, Algebra, Geometry, and Trigonometry."

[Arnott's Elements of Physics.—The Library of Useful Knowledge.—C. Hutton's Course of Mathematics, by Dr. Gregory.—and Lardner's Plane and Spherical Trigonometry, are all useful works on the subjects mentioned.—Ed. P. M.]

"J. B." would be glad to learn the best and most economical mope of obtaining a *solution* of *Indian Rubber.*

Indian Rubber, or Caoulchouc, is soluable in ether, the volatile oils, and petroleum. The ether, however, requires to be washed with water repeatedly, and in this state It dissolves It completely. Pelletier recommends boiling the Indian rubber in water for an hour; then to cut it into slender threads; to boil it again about an hour; and then to put it Into rectified sulphuric ether, In a vessel close stopped. In this way, he says, it will be totally dissolved In a few days, without heat, except the impurities which will fall to the bottom if other enough be employed. Berniard says, the nitrous ether dissolved it better than the sulphuric. If this solution be spread on any substance the ether evaporates very quickly, and leaves a coating of Indian rubber unaltered in its properties. Naptha, or peholeum, rectified into a colourless liquid, dissolves it, and likewise leaves it unchanged by evaporation. Oil of turpentine softens it, and forms a pasty mass that may be spread as a varnish, but is very long in drying.

"An Apprentice Woolwich," wishes to know what is the best material he can use, in order to fasten together the parts of a cardboard model he is constructing. Glue will not suit, and he wishes to know if any of the readers of the Penny Mechanic can inform him what substance is generally used by persons who construct models.

[Strong gum-water, with a little moist sugar mixed with it, would probably answer the purpose.]

*To the Editor of the Penny Mechanic.*

Sir,—In answer to the Queries of your correspondents "G. H. M." and "S. T. C." I beg to inform the former, that an excellent and durable varnish for balloons may be obtained by attending to the following directions.

Dissolve Indian Rubber cut small, in *five* times its weight of spirits of turpentine, by keeping them some days together; then boil one part of this solution in eight times its weight of drying linseed oil for a few minutes, and strain it; it should be used warm. The silk should be stout and strong, but no particular kind is necessary.

In answer to the other correspondent "S. T. C." the following is a method to ascertain "the specific Gravity of dry Sponge." Weigh accurately the dry sponge, then half fill a quart, (or any other vessel perfectly cylindrical) with water, marking the exact height by an internal line, then insert your sponge, and let it remain in some hours, so as to be completely saturated; mark again the height of the water, and weigh the quantity of fluid between the two marks; deduct the weight of the dry sponge, and the result will give you its specific gravity.

Brack's Brother.

## TO CORRESPONDENTS.

As we are obliged to go to Press early in the week, the favours of several Correspondents were obliged to remain unanswered this week.

"F. C. P." Silk, or Tissue Paper. Further directions will be found in the present Number.

We have received several letters containing answers to the Query of "G. H. M.," similar to the one we have inserted.

London: Printed at the Holloway Press, by D. A. Doudney; published by Berger, Holywell-street, Strand; and may be had of all Booksellers.

# THE PENNY MECHANIC.

A MAGAZINE OF THE ARTS AND SCIENCES.

No. XVII.] FEB. 18, 1837. Vol. I.

## MECHANISM OF A WATCH.

Fig. 1.

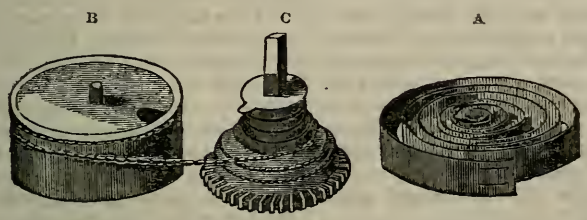



Fig. 2.

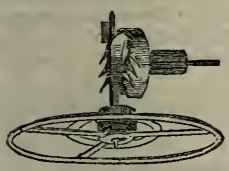


Fig. 3.

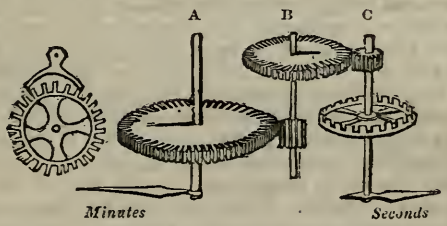



Fig. 4.

Holloway Press: D. A. Doudney.

## MECHANISM OF THE WATCH.

It too frequently happens that what we have the opportunity of witnessing every day, does not receive half the attention that is bestowed on less interesting objects which have the advantage of being presented to our notice less frequently. How many persons, for instance, will devote a considerable portion of their time and attention to examine a curious fossil, or some other rare production, when they have never taken the trouble of examining, what perhaps they have the opportunity of doing every day—the mechanism of a watch.

Our limits will not permit us to enter into the early history of watches, or to describe the progressive improvements that have been made in them. This subject we must leave for a future time, and at present describe the mechanism illustrated on the first page. We are indebted for the designs to Sir Charles Bell's notes in the last edition of Paley's Theology.

Fig. 1. represents the moving power of the watch. This is the steel spring A, which is enclosed in the *barrel* B, one end being fixed on the axle in the centre of the barrel, and the other to the inner part of it, by which means when the spring uncoils, motion is given to the other works of the watch, which communicate with the hands on its face, as will be presently described. The *Fusee* is represented at C, round this the chain connecting it with the barrel is coiled. When the watch is first wound up, the spring within the barrel is reduced into the smallest compass, and therefore it then of course exerts its greatest force in endeavouring to uncoil itself from around the axle. At this time it unwinds the chain from around the *upper* part of the fusee, and in order to render the force exerted by the spring as uniform as possible; the circumference of the *fusee* at this part is much less than lower down, and the leverage is consequently less. When the power of the spring loses somewhat of its intensity, from having partially uncoiled itself, its lever power over the fusee is increased by the increased diameter of the latter, and by this very ingenious contrivance the force exerted by the spring during the whole of the time it is unwinding the chain from the barrel is uniform. Its power as a lever increases as its power as a spring diminishes. The fusee alone, however, is not sufficient to render the power of the spring quite uniform. This is effected by the *Scapement*, Fig. 2. Underneath the balance-wheel a fine hair spring is coiled. This spring is alternately pulled and let go by a motion communicated to the wheel, and the spring, by the regularity of its motions, answers the purpose of a pendulum. The notched wheel below is the scapement wheel; two projecting *pallets* on different faces of the axle of the balance-wheel fall in succession between the teeth of the scapement wheel; when one of these slips off the teeth, and the axle is set free, the spring recoils, and delivers the other pallet into the succeeding notch; and thus the regular motion of the spring, without stopping the revolution of the scapement, regulates the time in which the teeth are let loose, and by this means equalizes the motion of all the wheels. The balance wheel and spring move with a quickness which permits the scapement wheel to beat 18,000 in an hour—the common rate of a watch that shows seconds. Another form of scapement is shown Fig. 3.

The wheel on the base of the fusee gives motion to the wheel A, which has 64 teeth; these fall into the *pinion* of the third wheel, B, which has 8 teeth, or *leaves* as they are technically called, the wheel itself has 60 teeth; these play into the pinion of the fourth wheel C, which has eight leaves. The central wheel going round once in an hour, the fourth wheel will go round 60 times in an hour, and with the hand attached to its axle it will mark seconds. This will be more easily understood by referring to Fig. 3. The wheel on the axis A, to which the minute hand is attached turns round once in an hour. Its sixty-four teeth play upon the pinion on the axle B; as this has eight leaves it will revolve *once* for every eight teeth of A, and consequently eight times during the whole revolution of A, that is in an hour. The wheel on the same axle B, has 60 teeth, which turns the right leaved pinion of

c; it will therefore turn the axle c seven times and a half during one revolution, or sixty times during the eight revolutions which B makes in one hour.

In order to move the hour hand, instead of motion being conveyed from the teeth of the wheels to the leaver of the pinion as just described, the reverse takes place, power is communicated *from* the pinions to the wheels. The wheel A in Fig. 4, goes round once in an hour, and the axle of this wheel passes through the dial and has the minute hand attached to it. The pinion of this wheel, called the cannon pinion, has 10 leaves, which play, during the hour upon a wheel B having 40 teeth, which accordingly is moved round only once in four hours. The wheel B, has a pinion of 12 leaves working into a wheel of 36 teeth, and must therefore make three revolutions to cause that to revolve once. But as the former B, requires four hours for one revolution, it must occupy twelve in making three, and consequently the 36-toothed wheel will take twelve hours to complete one. To its axle therefore the hour hand is attached. This axle is a cylinder which encloses the axle of the minute-hand so that both revolve, indicating the hours and minutes on the same circle of the dial. We cannot spare the room necessary for a description of the works of the watch complete; these, with some further remarks and another engraving, we shall give next week.

## NATIONAL BATHS.

There are few cities in the world so destitute as London of the means for promoting personal cleanliness by means of bathing. This is the more singular, because there is certainly no capital in which cleanliness is more strictly observed, than in our own metropolis. While, however, the inhabitants of Constantinople, and St. Petersburgh, have every facility afforded them for improving their health, and increasing their enjoyments by means of a bath, a denizen of "the metropolis of the world" has, till very lately, been almost without this necessary appendage to every city and large town. It is true that those who can swim may enjoy themselves in the Serpentine, but where is the poor fellow who cannot swim to go to, and where those whose constitutions will not allow them to plunge into a cold bath with impunity? Baths are not required only for those who can swim! It is necessary that every person who wishes to preserve health should frequently wash the whole body, and it is in order to enable every one to do this that baths are required. We know however very many persons who never do this, and yet they do not suffer from ill health; it would notwithstanding be folly to suppose that bathing is unnecessary. The skin has a certain office to perform, it throws off a certain quantity of perspiration. The quantity of useless matter thus removed from the system, and also the importance of the function, we have previously described in the first article on the "Human Body," and need not therefore now recapitulate.

But it must be borne in mind that unless the skin is kept in a healthy state, by frequent ablutions, it is not fitted to perform this function in a proper manner: the lungs and intestines are then made to effect what should be done by the excretory vessels of the skin, and from this cause a trifling cold, or slight attack of indigestion, is often productive of most serious consequences; when if the skin had been allowed to perform its proper action, nothing of the kind would have taken place. These facts are sufficient to show the importance of bathing, and it has frequently been regretted by Philanthropic individuals, and members of the medical profession; that the few baths in London, and the high charges for subscribing to them, prevented the great majority of the inhabitants attending so much to the cleanliness of their persons as they otherwise would have done.

We are happy to be enabled to direct the attention of our readers to an establishment which appears calculated to remedy many of the evils just described. We have lately had the pleasure of visiting the *National Baths*, Westminster Bridge Road, where not merely the gentleman, but the mechanic, can enjoy the pleasure of a tepid bath, for a sum that they can

both afford. The baths are formed on what was formerly the Lambeth market. The entrance fee to one is a shilling, to the other *three pence.* The shilling bath is 210 feet long and 60 feet wide. The Mechanics' Bath, as it is called, covers 12,000 superficial feet, and is supplied with 10,000 gallons of tepid water per hour. We have been informed that this water on comparison was found much clearer than that supplied to the house for domestic purposes! Now, when it is considered at how great an outlay of capital all this has been effected, we think the proprietors are entitled to much praise for conferring a substantial benefit on the working classes, by enabling them to avail themselves of the advantages of the bath for the trifling charge that is required for admission. We understand that on Sunday mornings, and after 4 o'clock in the afternoon, when the baths are open, the number who visit it show how highly the benefit is appreciated. At present this bath is undergoing repairs, but will be opened again shortly. We hope soon to see a similar bath established at the East end of London; we are only aware of one tepid bath—near the City Road, but that is too expensive for the artizan to visit frequently.

It is principally to the mechanics' bath we have described, that we wish to draw attention, but the shilling bath is a noble structure; like the former bath, it is constructed of stone, and contains 107 dressing boxes! It is also lighted with gas, so that the bath can be enjoyed in the evening as well as the morning. There is a cold plunging-bath attached for those who prefer it to the tepid-bath. The whole establishment is certainly on a larger scale than any we have ever seen or heard of in this country.

## ADVANTAGES OF STEAM CONVEYANCE.

Colonel Torrens, M. P., in his evidence before a committee of the House of Commons, made the following observations with reference to the employment of steam as a means of conveyance instead of horses. "It has been supposed, that there are employed on the common roads in Great Britain one million of horses, and a horse, it is calculated, consumes the food of eight men. If steam carriages could ultimately be brought to such perfection as entirely to supersede draught-horses on the common roads, there would be food and demand for eight millions of persons. But when we take further into consideration, that lowering the expense of carriage would enable us to extend cultivation over soils which cannot now be profitably tilled, and would have the further effect of enabling us to apply, with a profit, additional portions of labour and capital to the soils already under tillage, I think it not unfair to conclude, that were elementary power on the common roads completely to supersede draught-horses, the population, wealth, and power of Great Britain would at least be doubled."

The evidence of Mr. John Farey, engineer, on the subject, but more particularly with reference to steam carriages on common roads, will be read with interest.

He says, "Steam power will propel a carriage as cheaply at a quick rate as at a slower rate; that fact is proved on railways, in actual business: and steam-coaches will be the same whenever they can be made strong enough to bear quick motion without being overloaded with weight of machinery. That will be one of their great advantages over horse labour, which becomes more and more expensive as the speed is increased. There is every reason to expect, that in the end the rate of travelling by steam will be much quicker than the utmost speed of travelling by horses; in short, that safety to travellers will become the limit to speed, as is now the case on railways."

"What is your opinion as to impelling waggons by steam?"—"I have never considered that at all in detail, and am not prepared to give evidence upon the subject. The price of carrying passengers or goods at a quick speed, as is done by stage-coaches or vans, will always be so much higher than the prices of carrying an equal weight at a slow speed, as is done by waggons, that I see no inducement to attempt steam-waggons, which I think would present almost all the same difficulties as steam vans. According to theory, the cost of carriage by steam

will (as I have stated) be proportionate to weight and distance, without regard to speed of motion; for instance, to convey a coach loaded with two tons for a distance of ten miles only, the same fuel will be consumed and the same wear of machinery will be occasioned whether that distance is run in one hour or in four hours. The wages of engineers, conductor, and guard, will be only one-fourth with the quick speed, and the first outlay in machinery would be only one-fourth, because four times as many engines must be on the road, with their attendants, at the same time, to do the work at a slow speed, as at a quick speed; but the money earned by the carrier at the slow speed will be only a small part of what would be earned at the quick speed."

"Taking into consideration the comparative expense of horse-carriages and steam-carriages, do you suppose that steam-carriages will be able to run for half the charges of horse-carriages?"—"My own idea is, that steam-coaches will, very soon after their first establishment, be run for one-third of the cost of the present stage-coaches; but to become a business at all, it must necessarily be a business which will offer strong inducements to persons to embark in it; and to do that, the rate of profit must be very much greater than that which is commonly expected to be realized by the proprietors of stage-coaches; their present trade affords a less profit on the capital and trouble of management probably, than any other sort of business which is carried on with spirit in this country. The great reason of that is, the constant loss by destruction of horses, the fluctuations of the price and quality of horse-keep, and the impossibility of reducing stage-coach establishments in times when travelling business is flat; because the horses must be kept and men to attend them at all events, and the loss of running a coach half employed is not so great as suspending it, and keeping the horses idle on short allowance, till better times come round. The profit of stage-coaches which load well is very high, particularly in the fine travelling season, and that occasional profit creates an excitement which induces the injudicious setting up of more coaches than are wanted for an average of all seasons; and for the reasons above stated, their expenses, when once set going, cannot be reduced to meet bad times. The adoption of steam-coaches will set the trade free from its great commercial difficulty, because they can be laid up and kept idle without considerable loss, and brought out again when wanted without any new outlay; also fuel does not fluctuate either in price or quality to any considerable extent like horse corn. In short, the capital embarked in a steam-coach trade will not be so rapidly wasted as at present in horses. Owing to the great number of horses which must be first bought and then kept to do the same work as one steam-coach, the first outlay in stock will be very small in steam-coaches, compared with horses, the same of stables, hostlers and harness. The daily expenses of fuel and attendants will be very much less than that of horse keep and attendance; the wear and tear of the coaches and all that is coachmakers' work will be only the same as at present, but the wear and tear of engines and machinery, though a very expensive item on each engine, will be nothing to compare with the present repairs, loss and decay of horses, because the number of engines is so small. Stage-coach horses require to be all renewed every three years, notwithstanding a heavy annual expense for what may be called repairs of horses; viz. harness, shoeing, and farriery. Engines with an equally heavy annual expense of repairs to that of horses will, when perfected, be kept up thereby in such a state as to last for many years without renewal. The metal parts of machinery only wear at particular places, which are capable of being repaired or renewed, so that they become as good as new; but a horse when worn to disease at any part, feet, eyes, or lungs, becomes incapable of stage-coach work for ever afterwards."

## THE HUMAN BODY.

FOURTH ARTICLE.

In our former papers on the Blood, we

have described its general and vital qualities; we have now to examine its chemical constitution. Directly it is drawn from the body it coagulates; it separates into a solid called the crassamentum or clot, and a fluid termed serum.

The crassamentum or clot after a short period undergoes a change; the lower portion of it will be found to consist almost entirely of the red particles we have previously described, and the upper part of a substance termed *Fibrin*. The flesh of all animals is composed of fibrin. If we wash a piece of flesh until its red colour disappears, it will be found to resemble in many particulars the fibrin of the blood; and when examined by the anatomist, is found exactly similar to the fibres of which the flesh of animals is composed, when these fibres are divested of their coating of cellular tissue, and red colour. The manner in which the blood forms fibrin, is asserted by several eminent physiologists to be as follows. While the blood is circulating in the web of a frog's foot, or in the wing of a bat, an immense number of minute globules may be observed in it, by the aid of a tolerable good microscope. These globules are not confined to the blood of such creatures as a bat or a frog only, they exist in our own and consist of a vesicle with an exterior red coating. When the blood coagulates these globules burst; the red covering sinks to the bottom, and the colourless vesicles are said to adhere to each other and form themselves into fibres; these uniting together form muscle, Whether this be a true explanation of the formation of the flesh of animals or not, it is certain that fibrin is one of the most important constituents of the blood. It is found in all organized bodies, even where the blood is colourless, and is therefore evidently more important than the red particles.

The *Serum* or fluid in which the fibrin floats after coagulation. It is composed almost entirely of albumen, and a few salts. Albumen forms the white of egg, and this and the serum of the blood therefore very nearly resemble each other. If we expose white of egg to a certain degree of heat it coagulates; the same effect is produced on serum under similar circumstances. The acids also coagulate it the same as they do albumen. It is rather singular that carnivorous and other ferocious animals have but little serum in their blood, while timid animals, on the contrary, have a great deal. Albumen is the material out of which some of the most important tissues of animals and vegetables are formed. These we shall describe another time.

While the blood is coagulating a vapour rises from it which has been termed the *Halitus*. This is generally considered as a constituent of the vital fluid, although it appears to be merely a portion of the fibrin or red particles in an aeriform state. It is of a most disgusting odour; to it the butchers' shambles owe their unpleasant smell, and after a great battle, the air around the spot where it has been fought is said to be most offensive.

The last constituent of the blood remaining to be described, is what is well known as the gravy of meat. It is termed the *Serosity* of the blood, and may be obtained by coagulating the serum, and after cutting it in slices, subjecting it to pressure. When we place a joint of meat before the fire to roast, the albumen it contains is coagulated, and when we cut it, the serosity or gravy is accordingly given out.

We have stated that every portion of the body is formed from the blood, and the reader must have seen that some of the constituents of the body, such as fibrin, exist almost ready formed. The manner in which the other portions of the human frame, such as bone, &c. are formed from the blood, will be better understood if we give the result of the analysis of some of the more important substances of which the body is composed.

Berzelius, the most eminent chemist of the present day, gives the following as the analysis of the blood itself.

RED PARTICLES.

| | |
|---|---|
| Oxide of Iron ..... | 50·0 |
| Subphosphate of Iron... | 7·5 |
| Phosphate of Lime and pure Magnesia..... | 6·0 |
| Pure Lime ..... | 20·0 |
| Carbonic Acid and loss. | 16·5 |
| | 100 |

FIBRIN.

| | |
|---|---|
| Carbon | 53·360 |
| Oxygen | 19·685 |
| Hydrogen | 7·021 |
| Azote | 19·934 |
| | 100 |

SERUM.

| | |
|---|---|
| Water | 905·0 |
| Albumen | 80.0 |
| Muriate of Potass and Soda 6·0. Lactate of Soda and Anima Matter 4·0 | 10·0 |
| Soda, Phosphate of Soda and Animal Matter | 4·1 |
| Loss | 0·9 |
| | 1000·0 |

Out of these various substances, and a few that are created by their combination with each other, every part of the body is formed: for instance, bone consists principally of albumen and phosphate of Lime, these both exist in the blood; cartilage is only another form of albumen; which also principally constitutes the cellular tissue. Some of the secretions are formed by the decomposition of the components of the blood, and their reunion in different proportions, by which, of course, different substances are produced. The body, however, is entirely composed of oxygen, hydrogen, carbon, and azote. These combinations produce the following substances.

| | |
|---|---|
| 1 Gelatine. | 6 Resin. |
| 2 Albumen. | 7 Sugar. |
| 3 Mucus. | 8 Oil. |
| 4 Fibrin. | 9 Acids. |
| 5 Urea. | |

Some of these exist in the blood ready formed, others are formed out of it, in its passage through the different glands in which the secretions are elemented. It is in the very minute branches of the blood vessels that these changes are produced, and the capillaries have therefore very properly been termed the artificers of the body; the blood is the material, but the minute blood vessels are the builders. It is in them that the blood is changed into the different substances we have just described, and a most delightful study it is to endeavour to find out the means by which these extraordinary effects are produced.

## TO BREW CHEAP BEER.

THE following receipts for brewing beer very economically, will probably be acceptable to many of our readers. We found the receipts in a Number of the Gardeners' Magazine, and think their correctness may be relied on.

West India molasses is the best for the purpose. It is a kind of treacle which is sold as it comes from the West Indies, and is known by a gritty substance at the bottom of the cask, more or less like sand, which substance is, in truth, an imperfect sugar. Common treacle will do as well if the quantity be a little increased, say one pound in six or seven; but the best article of all is the coarsest brown sugar you can get; it is better than the higher-priced for this purpose; and you may use one pound in six less of it than of the West India molasses. It is, however, dearer upon the whole, though still much cheaper than malt. In making beer from unmalted barley, it is necessary to take good care not to use the water too hot, as, if it be, the barley will set, that is, become pasty, and not allow the water to drain off. Be very particular about this; a little oat chaff well mixed with the barley will go a great way to prevent this accident.

1. *Raw Barley and Molasses.*—The use of raw grain with molasses, for making beer, is a most valuable discovery for the middle classes. Put a peck of barley or oats into an oven after the bread is drawn, or into a frying pan, and steam the moisture from them. Then grind or bruise the grain roughly (not fine), and pour on it 2½ gallons of water, so hot as to pain the finger smartly. Mash it well, and let it stand three hours. Then draw it off, and pour on every two gallons nine of water, rather hotter than the last; but not boiling (say not above 180°). Mash the liquor well, and let it stand two hours before you draw it off. Pour on afterwards 2 gallons of cold water; mash well, and draw off. You will have about 5 gallons. Mix 7 pounds of West India molasses in 5 gallons of water; mix it with the wort from the barley; then add 4 oz. of hops, and boil one hour and a half. When cooled to blood heat, add a tea cupful of yeast; cover it with a sack, and let it ferment eighteen hours. In fourteen days it will

be good sound fine beer, quite equal in strength to London porter or good ale. The nine gallons of beer will cost—1 peck of barley, 1*s.* 3*d.*; 7 lbs. of molasses, 1*s.* 6*d.* to 2*s.*; 4 oz. of hops, 3*d.*: in all, 3*s.*, or at most, 3*s.* 6*d.*

2. *Malt and Molasses.*—Pour 8 gallons of water at 170° on a bushel of malt. Mash well; let it stand three hours; draw it off, and then add 8 gallons more water at 196°. Mash, and let it stand two hours: add 8 gallons of cold water to the grain, and let it stand three hours and a half. Mix 28 pounds of West India molasses in 20 gallons of water, and boil the whole with 2 pounds of hops for two hours. When the liquor is cooled down to 85°, add half a pint of yeast; cover it with a sack, stir it well, and let it ferment twenty-four hours. In proper time you will have 36 gallons of good ale for—1 bushel of malt, 9*s.*; 28 lbs. of molasses, 6*s.* to 8*s.*; 2 lbs of hops, 2*s.*: in all, 17*s.*, or, at most, 19*s.*

3. *West India Molasses only.*—Mix 14 pounds of West India molasses with 11 gallons of water; boil it for two hours with 6 oz. of hops. Let it become quite cool; add a tea-cupful of yeast, stir it up, and cover it over with a sack, to keep it warm. Let it ferment sixteen hours, put it into a cask, and keep it well filled up; bung it down in two days, and in seven days it will be fit to drink, and be stronger beer than London porter. This is the simplest of all; a washing copper and a tub, or even a large tea-kettle, only being requisite. Thus 9 gallons of beer can be made:—14 lbs. of molasses, 3*s.*, or, at most, 4*s.*; 6 oz. of hops, 4½*d.*: in all, 3*s.* 4½., or, at most, 4*s.* 4½*d.*

A small quantity of copperas, or vitriol of iron, about as much as will lie on the point of a small knife, is in general use, to give beer a head, and make it drink pleasant and lively. It is not necessary, but it is not unwholesome in any respect. —Y. A. B.—*Gard. Mag.*

### AERONAUTIC SOCIETY.

A Society bearing this title has recently been established. Their object is to facilitate the survey of countries, and perhaps make balloons useful in time of war. We are informed that they intend to endeavour to get an act of incorporation, though the capital to be raised is small. We wish they *may* get it!

## INSTITUTIONS.

### LECTURES DURING THE WEEK.

*London Institution*, Finsbury Circus.—Thursday afternoon, Feb. 23, at one o'clock, R. Addams, esq, on Acoustics.

*London Mechanics' Institution*, Southampton-buildings, Chancery-lane. — Wednesday, Feb. 22, E. Cowper, esq., on Common Weaving.—Friday, Feb. 24, Election of Officers, both at half-past eight.

*Western Literary and Scientific Institution*, 47, Leicester-square.—Thursday, Feb 23, at half-past eight, Mr. Buckingham, M. P., on Oriental History.

*Aldersgate-street Institution*—Wednesday, Feb. 22, at eight, T. J. Searle, esq., on the Drama.

*Islington Literary and Scientific Society.*—Thursday, Feb. 23, at eight, Dr. Trueman, on Digestion.

*Eastern Atheneum*, Stepney Square.—Wednesday, Feb. 22, C. H. Purday, esq., on the Music of Various Nations, with Vocal Illustrations, at eight.

*Poplar Institution*, East India Road.—Tuesday, Feb. 21, W. Lukeing, esq., on Electricity, at eight o'clock.

*Westminster Mechanics' Institution*, Grosvenor St., Millbank Row.—Tuesday, Feb. 22, S. Logan, esq., on Phrenology, at eight.

*Kenlish Town Mechanics' Institution.*—Monday, Feb. 21, S. Logan, esq., on Phrenology, at eight.

### TO CORRESPONDENTS.

"R. F. R." We shall perhaps be able to make use of his paper for some future Number.

"Swolby" says, "I am desirous of knowing the velocity of ignited gunpowder, supposing an equal quantity placed regularly along a fluited instrument, a distance, i. e. of twenty miles."—How does he expect his query can be answered?

We are much obliged to "J. R. S." for his note.

"Young Balloon's" Letter did not reach us in time for insertion with the others on the same subject.

We shall be happy to do all in our power to assist the "Westminster Mechanics' Institution."

The third letter of "Mr. Rough's" shall be Inserted in a Number or two.

A letter "on the evils produced by Machinery, and showing that the working classes have been more injured than benefited by it," shall be inserted next week.

"W." should have written to us by Monday. We are obliged to go to press early in the week.

If the books are forwarded to us by "M. M.," we shall be happy to notice them.

The articles of those Correspondents we have not answered individually are accepted.

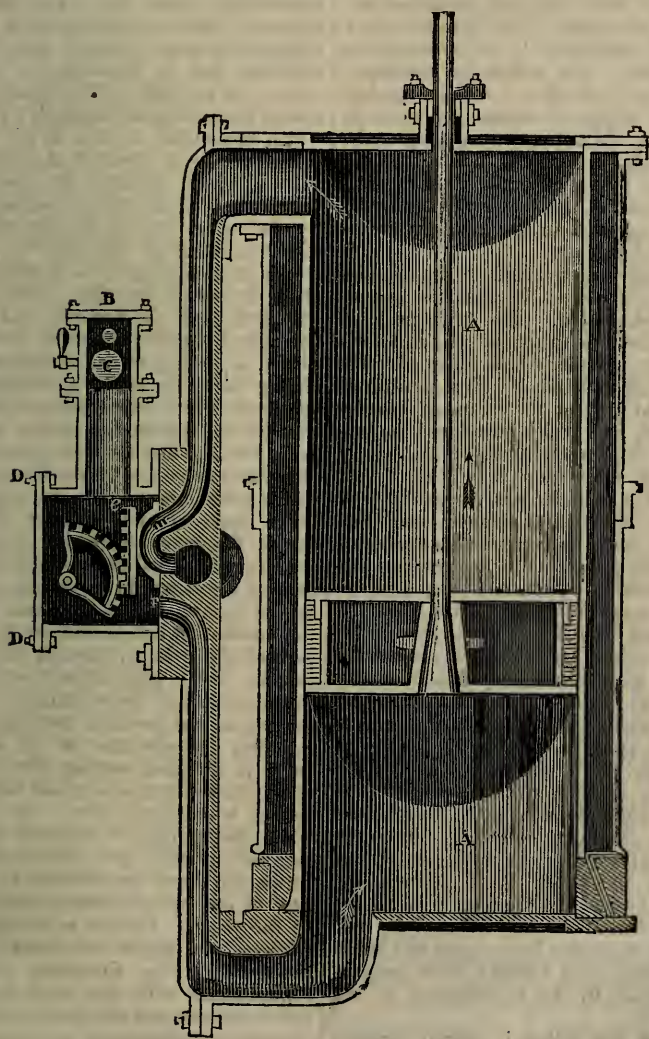
London: Printed at the Holloway Press, by D. A. Doudney; published by Berger, Holywell-street, Strand; and may be had of all Booksellers

# THE PENNY MECHANIC.

A MAGAZINE OF ARTS AND SCIENCES.

No. XVIII.] SATURDAY, FEB. 25, 1836. Vol. I.

DOUBLE ACTING ENGINE.






Holloway Press: D. A. Doudney.

### DOUBLE-ACTING ENGINE.

Of those who have contributed to the improvement of this vast machine, beyond all others must be ranked James Watt, who was originally a mathematical instrument maker in the city of Glasgow. In 1765, he was employed to repair the model of Newcomen's steam-engine, belonging to the university of that place; and while examining this imperfect apparatus, he observed the immense loss of steam occasioned by its admission to the cylinder, just cooled for condensation. He found, that a certain number of cubic inches of steam, generated in the boiler, did not operate as they ought in producing a vacuum. In fact, he ascertained by experiments, that one half of the steam of the boiler was lost by its being condensed in the cylinder previously cooled.

He therefore resorted to several different contrivances in order to prevent this condensation. He first made a wooden bottom to the piston, and then made the cylinder wholly of wood. He afterwards inclosed it with a packing of hemp, to prevent the escape of heat by radiation, and finally introduced the important improvement of condensing the steam in a separate vessel, by which means the cylinder was constantly preserved at the boiling temperature. His earliest model is constructed upon this admirable principle, in the practical developement of which, it is stated he received considerable assistance from the celebrated Dr. Black, whose discoveries on the subject of heat then excited the general attention of the scientific world. The first improvement then made by Watt consisted of the addition of a condensing cylinder, into which the steam, after raising the piston, was allowed to pass, by opening a valve, where it condensed without lowering the temperature of the working cylinder. The next great improvement he made was that of making the steam itself depress the piston, instead of the pressure of the atmosphere. This was effected by admitting the steam both above and below the piston, in a manner which may be understood by an examination of the diagram.

When the piston is merely pressed down by the weight of the atmosphere, it is obvious that the pressure cannot be greater than about 15lbs. to the square inch; but by admitting steam above the piston, and thus effecting its depression independent of atmospheric pressure, as in the above diagram, the force with which it is driven down can be increased to an almost unlimited extent.

The cylinder A is furnished with a steam-tight piston, the rod of which is connected with the working beam. This cylinder, instead of being open at the top, like that in Newcomen's steam-engine, is air tight. The steam is admitted from the boiler through a pipe, of which the orifice is seen at B. Below this opening is situated the throttle-valve *c*, which regulates the quantity of steam admitted through the steam-pipe, by closing or opening in proportion to the divergency of the governor, with which it is connected, in a manner we shall hereafter describe. The steam passes through the box D D, and enters the cylinder either above or below the piston, according to the situation of the sliding valve, or bridge *e*, contained in the box, which being elevated or depressed by the motion of the toothed arch, working into the teeth of the valve, alternately opens and closes the apertures which communicate with the upper and lower parts of the cylinder. In the figure, the lower aperture P is open to the steam box, and the steam is entering beneath the piston, in the direction shown by the arrow, and at the same time a communication is formed from the upper part of the cylinder through the aperture *m*, to the pipe through which the steam passes into the condenser. When the piston has reached the top of the cylinder, the direction of the sliding-valve is changed, so that the pipe *m* opens into the steam-box, and the elastic vapour is admitted above the piston, while the aperture P is placed in communication with the condenser, into which the steam passes from the lower part of the cylinder during the descent of the piston. By this admirable contrivance, the upper and lower parts of the cylinder were alternately made to communicate with the steam-box and the condenser, and the piston being both elevated and depressed by the power of steam alone, the machine, in the hands

of Mr. Watt, became a real steam-engine. All these improvements were secured to Mr. Watt by right of patent.

## MR. POCOCK'S KITE CARRIAGE.

*To the Editor of the Penny Mechanic.*

SIR,—Having formerly been the pupil of Mr. G. Pocock, and therefore necessarily having had frequent opportunities of inspecting and riding in his kite carriage, the following brief account of it may be interesting to your readers.

The kites were full feet in height and proportionably wide, they were covered with linen instead of paper, and had so much power, that one of them could drag a man across a field without his having power to stop himself. They were fastened to the carriage by means of cords, and could be drawn in at pleasure. The carriages were made as light as possible, something in the shape of an invalid's chair, only on four wheels, and capable of containing three persons; they were guided in the same way as a steam carriage.

I recollect about six years ago I travelled from Bristol to Gloucester in one of these carriages in company with Mr. Pocock and a school-fellow, and the greatest difficulty we had to overcome were the hills, as the force required to carry the carriage up a hill, would be too great were it upon level ground, so that one of us was obliged, when we came to any rise, to get out of the vehicle and go behind to help push it up. We were overturned when about two miles from Gloucester, owing to our having turned a corner too sharply, but happily escaped with few bruises, whilst our poor carriage eased of its weight, and having no one to guide it, was dragged with considerable velocity across a field, and we were some time before we were able to overtake it.

Since that time Mr. Pocock has been to London, and showed his carriage to some of the Royal Family, who expressed their approbation of it.

I am Sir,
Your most Humble Servant.
H. BAKER.

## RESULTS OF MACHINERY.

*To the Editor of the Penny Mechanic.*

SIR,—The influence of machinery on the well being of the working classes is so important, that I trust you will allow me to occupy a portion of your magazine with a few observations on the subject; not because I presume I shall be able to throw any new light upon it, but knowing your work circulates extensively amongst the working classes, I hope the remarks may be the means of directing their attention to a question that so intimately concerns them.

The opinion that machinery has been productive of more evil than good, is generally entertained by the working classes themselves, and seeing that they are the parties more immediately affected by the introduction of machinery, I think their opinion has not been treated with the consideration it deserves. It has been said to be the result of ignorance, and in order if possible to remove it, the Society for the Diffusion of Useful Knowledge, some time ago published a little work, said to be written by Lord Brougham, or Mr. Babbage, entitled, "the Results of Machinery, namely, cheap production and increased employment." Although, Sir, I shall no doubt subject myself to be classed by some persons amongst the ignorant, if not the mischievous portion of society, by the remarks I am about to make, yet I am so firmly convinced of the truth of my proposition, that I shall brave all this, and more—be ready to answer any objection that can be raised against the point I maintain.

This is, that the introduction of machinery has always been more prejudicial than otherwise to the *working classes.* I must beg it to be observed, that I allude particularly to the *working classes.* That machinery has been highly beneficial to society at large; that without it we should not possess a tithe of the comforts we now enjoy, and that on its improvement we must depend for the social, moral, and political improvement of society, I am at once ready to admit; but this does not at all affect the opinion I have just expressed, as I shall presently show.

The term machinery has been applied to every instrument by which man seeks to increase or render more available his physical strength. I might draw a distinction between a tool and a machine, but for the sake of the argument, I am

willing to admit that a spade, or a hammer, is as much a machine as the spinning frame, or the printing press. The effects produced on the working classes by their introduction are however widely different. The first may assist without injuring the labourer; the latter by performing his work, necessarily deprives him of his means of subsistence.

Those who look to the more extended employment of machinery for the general improvement of society, point out as one of its greatest advantages, that it lessens the demand for human labour; and, say they, when machines shall be constructed so efficiently, that the various servile occupations now performed by human labour, shall be performed by them, then will every man be able to devote himself to the acquisition and diffusion of knowledge, and the greater portion of the misery and vice that now exists will be removed! Whether such a consummation "so devoutly to be wished," will ever be effected by machinery, or by any thing else, it is not necessary here to inquire, for even admitting it to be probable, it does not in the slightest degree invalidate the proposition I have laid down, on the contrary, it confirms it. This I may prove by the first paragraph in the little work, on the Results of Machinery, I have just spoken of. "In the year 1827, a Committee of the House of Commons was appointed to examine into the subject of emigration—that is, to see whether it was desirable and practicable to remove distressed labourers from the United Kingdom to distant places, where their labour might be profitably employed to themselves and others. The first person examined before the committee was Joseph Foster, a working weaver of Glasgow. He told the committee that he and many others, who had formed themselves into a society, were in great distress; that numbers of them worked at the *hand loom* from eighteen to nineteen hours a day, and that their earnings at the utmost did not amount to more than *seven shillings a week*, and that sometimes they were as low as *four shillings*. That twenty years before that time they could readily earn a pound a week by the same industry; and that as *power-loom weaving had increased, the distress of the hand-weavers also had increased* in the same proportion. A power-loom is one worked by machinery, and not by the hand of man. The committee then asked Joseph Foster whether he attributed the insufficiency of the remuneration he received for his labour to the introduction of machinery? To this he answered that he did, but he did not consider the introduction of machinery objectionable, and was perfectly aware that machinery must go on, will go on, and that it is impossible to stop it."

By Foster's evidence we perceive the tendency of machinery. The power-loom can weave more rapidly and economically than the hand-loom, one of the former can, perhaps, supply the place of twenty or a hundred of the latter—the demand for human labour is therefore diminished—but what is the result to the working classes? Why, Joseph Foster who formerly received a pound a week, is glad to get six or seven shillings. Is not the same result to working men invariably produced by the introduction of machinery? Is not the working man invariably the sufferer?

It may perhaps be said, that as machinery lessens the cost of production, therefore, though the wages of the workman may be reduced, yet as he can procure the necessaries and luxuries of life more cheaply, the benefit arising from that circumstance is sufficient to counterbalance the distress occasioned by the reduction of wages. A little consideration will show the fallacy of this assertion. Will any one maintain that Joseph Foster, or any of the hand-loom weavers who are now so dreadfully distressed, can procure the necessaries of life as easily with the trifle they at present earn, as they could when the wages were higher, though the necessaries may have been dearer? If so why are they distressed?

In conclusion permit me to observe, that the great error, I conceive, into which persons fall when considering the effects of machinery, is this—they see the comforts it has procured for themselves—they see that it tends to improve society generally, and they therefore overlook its effect upon the *working classes*. In most cases I know that when the cost of any particular

article of manufacture is reduced, there is always an increased demand for it, but this has seldom been sufficient to call again into employment, as the conductors of machines, those who had been thrown out of work when the machines were first introduced. Another class of workmen is then employed; and those who worked on the old plan have to bear all the distress occasioned by the alteration.

I am, Sir,
Your obedient Servant,
S.

## SHIPWRECKS.

### NO. III.

*To the Editor of the Penny Mechanic.*

SIR,—In this article I will explain how "the provision, cargoes, and lives of crews and passengers, can be saved from ships that are water-logged," and how they "can be safely brought into port." See p. 85 and 86, P. M.

In explaining my plan, for saving life and property from shipwreck, I will use the cubical yard and the cubical foot, as my measures. Each of these measures must be similar in workmanship, whilst their proportions are as 27 to 1. The measures I speak of, are inside measures, for the cubical yard; and outside measures, for the cubical inside foot.

The Chinese tea-chest, is a frail, weak, and leaky structure; but a chest made of inch boards, and covered with sheet-iron, with one iron lining in the centre a quarter of an inch thick, and half an inch broad, would be a substantial structure. Let us, therefore, imagine that a chest of this description, one yard every way, inside measurement, is constructed; that the *centre* of the upper face of this cube, is a circle two feet diameter; that the rim of this circle is a female screw, and that the top which fits in it is a male screw. Let us imagine, that four iron tubes, three quarters of an inch inside diameter, are passed through this cube in such a manner, that the outsides of the tubes, will touch the insides of the cube, and that the whole is perfectly water-proof. Now the inside measurement of this cube being one yard, twenty-seven cubes, similar in structure, each, one foot outside measurement will fit inside this: and by removing the part of the iron bar, at the diameter of the top face of the great cube, the twenty-seven small ones can be stowed away. Now these twenty-seven boxes, can each be filled with any thing else as well as tea: concentrated meat, bread, or liquors of double, or treble strength, could be preserved in them; by which double the space would be allowed for water, the article most wanted (in general) in case of shipwreck.

In stowing these cubical chests, we will suppose that the lower deck is flat, and without curvature, perfectly horizontal. Any number of them (with, or without the internal cases,) may at the time of stowage be formed into a seagoing raft, and as they are passed forward on the deck on which they are to remain, four iron bars are to be past longitudinally, through each cube, horizontally.

Assuming the length of this oblong raft to be thirty feet inside measurement, and twelve broad; for the bows and stern of this raft, I would have semicircular chests, the radius of which should be half the outside breadth of the raft. The bows and stern might be all iron, and much stronger than the body of the raft. To the bows should be affixed a cut-water; and to the afterpart a stern post; neither should rise or fall below the level of the cube; but, in the top and bottom of both, screw holes should be sunk, for such purposes as may hereafter be described.

These iron bows, being placed foremost, with similar holes horizontally, in right lines with the tubes, in the cubes, the iron bars being past through all, and through the cutwater, by nuts, the whole is consolidated into one seagoing boat, which is divided into four equal, and two unequal divisions. The union of these four is accomplished as follows, Let horizontal tubes, similar to those described, cross the aforesaid tubes at right angles, and let their outsides coincide with the outsides of the aforesaid internal tubes; by these means, and with the assistance of bars passed through the tubes, the whole will be consolidated.

The entire number of bars for this raft are sixteen long, and forty short. It must here be carefully observed, that the measurement of provision cases of this description, is not of necessity confined to any particular length or breadth; but, on the position of the hollow tubes, the success of all depends: these must be placed in right lines with each other, for if they are not, the raft cannot be consolidated. For the stanchions that are to be set up, in the centre of the outside of each cube, I would sink perpendicular hollow tubes; and the first upper six inches of these tubes should be a female screw, the lower six inches of each stanchion should be a male screw; in the centre of which, or, immediately above the screw, there

should be a joint that would allow the stanchion to be turned down on the deck, and secured by a spring that would colapse the eye-bolt. There should be only one stanchion in the centre of the outside of each cube.

The head and stern parts, we will now call the forecastle and poop. In the former, the anchors and chain cables may be stowed; and in the latter, the sales and rigging can be kept. A central case, the whole length of the raft, of any breadth from one foot, to two or three feet, may be reserved for the masts; and this central case, being made stronger than the cubes, the hatches of it will be oblong squares, which may be made into one opening by moveable beams, that can be secured by screws at pleasure. The hatches may be made to fit in on the upper rim of the central case, and with the solution of India rubber, the whole may be water-proof! The right angular horizontal tubes in the central case, being in right lines with the tubes in the cubes, the central case may be six inches, or nine, or twelve, below the lower part of the cubes. This will answer (if of the proper length), for a step for the cutwater and stern post, in both of which are countersunk holes for screws as before mentioned.

Steps for the mast or masts, (according to the size) may either be made in the bows or poop; or in the central piece; or in all. Now it is evident that all the parts of this horizontal raft, if not covered by lumber or other stowage, can be easily got at, whilst the ship is prosperously pursuing her voyage; but in the event of striking against a rock, the locality of the raft, would occasion the raft and all the cargo, on the present system, to be lost! But, by an improvement on the present system of building, (not in shape but in convenience) the ship, the cargo, and the crew, in nineteen cases out of twenty can be saved, if made of good timber, or of metal that will not injure the flavour of the tea. The cubical chests will last one hundred voyages to India; and by printing instructions for saving life from shipwreck, and by pasting them on two sides of each cube, large and small, and by covering the whole with a transparent solution of India-rubber, kings, statesmen, philosophers, mechanics, and seamen, could receive that knowledge which would enable them to save life and cargoes from destruction by shipwreck.

I remain, Sir,
Your obedient Servant,
M. Rough.

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## ADVANTAGES OF STEAM CONVEYANCE.

"Of course, a steam-carriage going slower than ten miles an hour will be more expensive to travel, on account of the greater expenditure of fuel?"—"No; the consumption of fuel, according to time, would be as much less as the motion would be slower; so that the consumption of fuel, according to distance, would be the same, whether for a quick speed or for a slow speed; but when profit is considered, every thing is in favour of quick speed; because all goods carried slow must be carried cheap; and quick conveyance will bear the highest price of carriage, on account of the expense of going quick by horses. For instance, a ton of goods may be carried a mile by steam-power with a certain consumption of fuel, but it should take no more fuel to carry it a mile at the rate of two and a half miles an hour than at ten miles an hour; there is some qualification to be made in that statement according to the state of the roads; it will be true if they are hard and good, but if they are heavy, the expense of fuel will be a little more for the quick speed than for the slower speed; and it is also to be understood, that the engines must be suitably proportioned for attaining quick speed, because engines which are only adapted for slow motion do not work to so great an advantage when they are urged to work quick, as when they are worked at or below the speed which the proportions of their parts are adapted to move with; nevertheless, that extra expense of going quick by steam-power will be but small, and nothing like the increased cost of travelling quick with horses; for horses have only a limited speed at which they can travel if they have no load to carry or drag after them, the whole of their muscular strength being then required to advance the weight of their own bodies; the speed with which stage-coaches now travel approaches so near to the speed with which the horses could travel without any load, that their force of draught becomes very small. In all cases, horses lose force of draught in a much greater proportion than they gain speed, and hence the work they do becomes more expensive as they go quicker. The quickest stage-coach travelling is now at the rate of eleven miles an hour,

and that appears to be very near to the utmost limits which nature has prescribed for animal exertion; for those horses require renewal of the whole stock every two or three years. This is a comparison of steam-power and horse labour, during the time that each is actually in operation; but the real difference between the performance of a steam-engine and that of a set of horses will be found to be very great, when it is considered, that by having one spare steam-coach for every two or three which are on the road, those coaches can travel continually all the year round, during fourteen or fifteen hours in every twenty-four hours, without any intermission, except stopping for one or two minutes to take in water at every stage of about seven or eight miles; and thus each steam-coach can travel 140 or 150 miles a-day; whereas a set of four stage-coach horses can only work during seven hours and a half out of every twenty-four hours, or each horse can run fifteen miles a-day, and that exertion wears them out very soon. A cart-horse, travelling at the rate of two miles and a half an hour, can work during eight hours out of every twenty-four hours, or he can travel twenty miles in a day. Suppose that in both cases, of horses going ten miles an hour or only two miles and a half an hour, the force of traction was the same during the time that they were actually drawing; even on that supposition, there would be the difference between twenty miles a-day and fifteen miles a-day in favour of slow travelling; but in considering the work performed, the great loss in the force of draught by quick travelling must be taken into account; and it will be found that a cart-horse, walking at two miles and a half an hour, could draw with a force of traction 100lbs. on an average, but that a stage-coach horse, running at ten miles an hour, cannot exert more than 28lbs. force of traction at an average. The above proportions of distance travelled and force of traction exerted in each case being combined into one product, the proportion will stand thus:—20 miles a-day multiplied by 100lbs. draught is equal to 2000, to represent the work done by a horse travelling at the rate of two miles and a half an hour, and 15 miles a-day multiplied by 28lbs. draught is equal to 420, to represent the work done by a horse travelling at the rate of ten miles an hour, which is $4\frac{3}{4}$ to 1 in favour of a slow speed; when with steam power there would be only a very slight difference of performance, at the quick or the slow speed.

## MISCELLANIES.

*The Davy Lamp.*—A series of experiments were lately performed at the *Adelaide Gallery of Practical Science*, on the comparative safety of the Davy Lamp, and those invented by Messrs. Newman, W. Martin, and Sir J. Martin. When the lamps were quietly immersed in a compound of hydrogen, common coal gas, and atmospheric air, no explosion took place; but when a jet of these mixed gases were suddenly forced against the lamps, none were sufficient to prevent explosion. Sir John Martin, on behalf of himself and his brother, at once admitted that their lamps were not safe! The subject will be thoroughly investigated by a Committee of the House of Commons this session. The *Mining Gazette*, to which we are indebted for these particulars, states that Mr. Pease, the chairman of the committee, and Major Banks, the Member for Dudley, are both engaged in preliminary operations for bringing the matter before Parliament.

*Mr. Cross's Experiments.*—In reference to the experiments of this gentleman, described in Number 14 of the Penny Mechanic, one of his friends has written to the Newspapers, stating, that Mr. Cross had written to him denying the truth of the statements published as an account of the experiments, and giving altogether a new version of the story. The spontaneous production of the insects is however asserted to have taken place, though under very different circumstances to those detailed in the newspapers. What a pity it is Mr. Cross does not write *himself* to some of the leading philosophical journals, and elucidate this matter. His not doing so is really surprising, considering how much discussion has taken place on the subject.

*The Greenwich Railway.*—The number of passengers have surprisingly in-

creased within the last fortnight. During the fine weather the carriages have been quite filled with passengers. This looks well for the future success of this railroad!

*School of Design.*—A council has been formed for the purpose of making the necessary preliminary arrangements for opening this institution. Amongst the names we perceive those of Messrs. Calcot, Cockerell, Eastlake, Sir Francis Chantery, all Members of the Royal Academy, also several members of Parliament; and Mr. Pellatt, the glass manufacturer; Mr. Thompson, of Clithero, calico printer, and Mr. Alderman Copeland, M. P., china warehouseman. The school will be opened as soon as possible.

*Zoological Society.*—At the last general meeting the receipts of the past month were announced as 2146*l.* 12s. 2d., and the expenditure 1019*l.* 6s. 3d. several presents were announced both to the menagerie and museum, and the number of visitors to the former was stated as 1666, from whom 42*l.* 14s. was received, and to the latter, 219, the sum received being 4*l.* 1s. It was also stated that Mr. Yarrell, who has officiated as Secretary since the decease of Mr. Bennett, has agreed to retain that situation, without emolument, provided an Assistant Sec. be appointed, which the council are taking steps to provide. The number of mammalia at the Gardens at the last report was 298; the number received since was 5, and the number of deaths 9, making a present total of 294; the birds at the former date were 702; those received since were 4, and the number of deaths were 13, making a present total of 693; and 3 reptiles had been added, making 27; the present total of stock being therefore 1008.

*Diamonds.* — A. M. Perrot, of the Royal Academy of Sciences at St. Petersburgh, after a careful examination of perfect and imperfect diamonds, is of opinion that they are formed by some volcanic action on small pieces of carbon, or of a substance composed of a large portion of carbon and a very small quantity of hydrogen.

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## INSTITUTIONS.

*London Institution.* Finsbury Circus.—Monday, Feb. 27, C. Clark, esq., on British Poetry.—Thursday, March 3, R. Audains, esq., on Acoustics. at seven o'clock.

*London Mechanics' Institution*, Southampton-buildings, Chancery-lane.—Wednesday, March 1, Quarterly Meeting.—Friday, March 8, E. Cowper, esq., on Weaving, at half-past eight.

*Aldersgate-street Institution*—Wednesday, March 8, at eight, T. J. Searle, esq., on the Drama.

*Western Literary and Scientific Institution*, 47, Leicester-square.—Thursday. March 2, at half-past eight, Mr. Buckingham, M. P., on Oriental History.

*Eastern Atheneum*, Stepney Square.—Wednesday, March 1, J. H. Elliot, esq., on the Education of the Senses, at eight.

*Islington Literary and Scientific Society.*—Thursday, March 2, Mr. Downs, on Steam Power, at eight.

*Westminster Mechanics' Institution*, Grosvenor St., Millbank Row.—Wednesday, March 1, R. F. Showler, esq., on the Circulation of the Blood, at eight.

*Poplar Institution*, East India Road.—Tuesday, Feb. 28, S. Logan, esq., on Phrenology, at eight.

*Kentish Town Mechanics' Institution.*—Monday, Feb. 27, F. H. Showler, esq., on the Circulation of the Blood, at eight.

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### TO CORRESPONDENTS.

"Mr. John King." If it is wished to exhibit the model, we know no better place it can be taken to than the Adelaide Gallery of Practical Science, Strand. This Correspondent was by mistake called "T. King," in Number Nine.

"F. P. S." The Loadstone has an attractive power; how this is communicated to steel is a mystery.

We are much obliged to "Mr. Cooper," and shall probably be able to make use of his paper shortly. The query shall be answered by an article on the Phenomenon.

"Mr. Wivell" is not forgotten, but an unforseen event has prevented our attending to his request.

"A City Apprentice." The Pole Star may be found by means of two stars in the constellation of "the Great Bear," which point directly to it. If "a City Apprentice" does not know "the Great Bear," he had better apply to some intelligent friend.

We will find room for Mr. Baker's letter on "Land Skates."

Ritchie's "Perpetual Motion" shall be inserted shortly.

"King's Force Pump" and "Mode of Filling Steam Boilers" are ingenious. They shall both appear the first opportunity.

Every body thinks they can do two things better than any one else, viz. Stir a Fire, and Govern the Nation. We have no doubt "A Young Gentleman," can do both far better than the friend, whose manner of using the poker so much offends our correspondent.

The continuation of the article "on the Mechanism of a Watch," is omitted this week from press of other matter, but it shall appear in the next Number.

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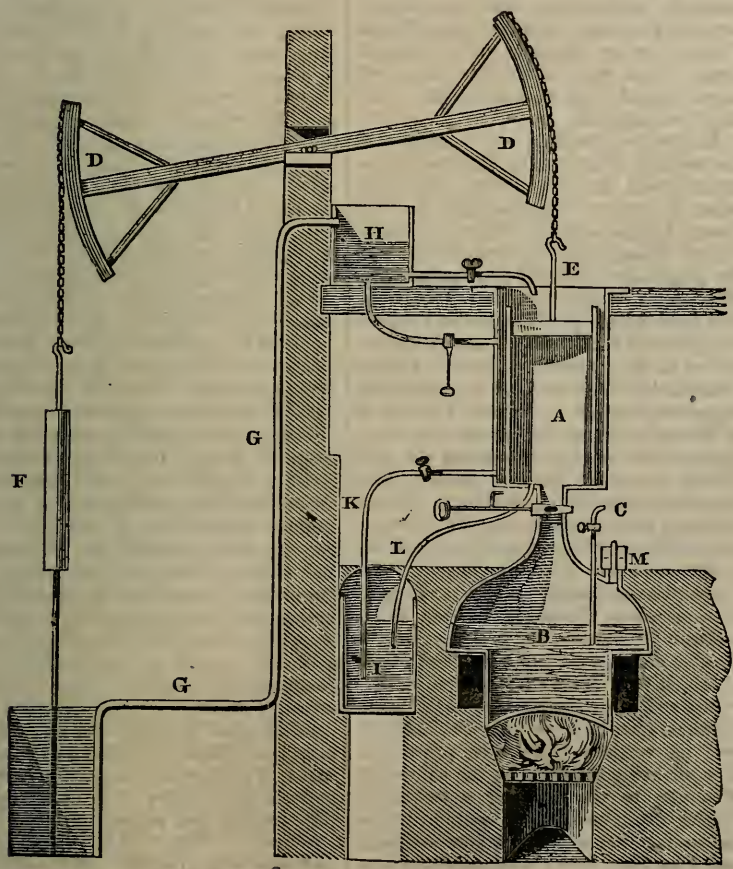
# THE PENNY MECHANIC.

A MAGAZINE OF ARTS AND SCIENCES.

No. XXIII.] SATURDAY, APRIL 1, 1837. Vol. I.

THE ATMOSPHERIC ENGINE.






Holloway Press: D. A. Doudney.

## THE STEAM ENGINE.

NO. VII.

The greatest improvements in machinery have generally been made by working men; and however honourable it may be to them that the spinning machine owes its excellence to one of their number, it is still more to their honour that the Steam Engine is entirely the result of *their* ingenuity. Whatever may be thought of the Marquis of Worcestor's invention, it is quite certain that all he made known had previously been discovered; but whether this were the case or not, the improvements in the Steam Engine we are about to describe, and those which were afterwards invented, were certainly not caused by his lordship's experiment.

In 1707, a plumber and a smith, of the town of Dartmouth, Thomas Newcomen, and John Crawley, made the most important improvement in the Steam Engine of any we have yet described. They constructed what is termed the *Atmospheric Engine* (see engraving). The steam is generated in the boiler B, and is admitted into the cylinder A, when the piston is forced to the top as represented in the engraving. D D is a large beam or lever, moving on an axis, and supporting at one extremity the rod E of the steam piston, by means of a chain passing over an arch of wood at the end of the lever or working beam. The reason for employing this arch will be obvious, if we consider that the distance of the extremity of a common lever from a perpendicular beam supporting the fulcrum is continually varying, and would therefore draw the piston rod out of its vertical direction; but by attaching a flexible chain to part of a circle of wood, of which the fulcrum is the centre, the piston rod is constantly kept at the same distance from the perpendicular beam, and its vertical motion is preserved. The air being expelled by the admission of steam to the cylinder A (which is placed within an exterior cylinder), the communication with the boiler is closed, and a portion of cold water admitted outside the cylinder from the reservoir H, which instantly condenses the steam, and forms a vacuum below the piston, which is then forced to the bottom of the cylinder by the pressure of the atmosphere. To the opposite end of the lever beam the pump-rod is suspended, furnished with a counterpoise F, to elevate the piston-rod after its descent in the cylinder. The piston being thus alternately elevated and depressed, a quantity of water will be raised from the well at every stroke of the engine, in proportion to the force with which the atmosphere presses upon the piston. M is a safety-valve, and C a small pipe descending into the water in the boiler, for the purpose of ascertaining the quantity it contains; for if the cock at C is opened while the lower extremity of the pipe is immersed in the water, the elasticity of the steam will force water through the aperture; but if the surface of the water in the boiler is below the end of the pipe, only steam will issue when the cock is turned. G G is a tube communicating with the well to supply condensing water to the reservoir H. K and L are pipes for conveying the water formed by the condensation of the steam on the interior and exterior of the cylinder, into the well I. We have previously mentioned that the pressure of the atmosphere is about 15lbs. on every square inch of surface; and also that if we filled a vessel full of steam and then condensed it, we could produce nearly a perfect vacuum. It was from a knowledge of these facts, that Newcomen and Crawley were enabled to construct their engine. Savery gained power by condensing steam in a vessel, and thereby enabling the atmosphere to press a column of water into it, provided it did not exceed a certain height. Newcomen and Crawley thought they might gain power more certainly, by allowing the pressure of the atmosphere to act directly upon the surface of a piston moving in a cylinder, where a vacuum could be produced by the introduction and condensation of steam. On this idea they constructed their engine; and so economically can it be constructed, and so effectual is it in its operations, that in many parts of the country it is used even in the present day instead of those constructed by Watt. It is evident that a piston moving air-tight within a cylinder would be forced upwards if steam was admitted under it, and that if this steam were condensed, the pressure of the air would be sufficient to force it down again, thus producing a motion that could easily

be communicated to different kinds of machinery, besides being employed in raising water; this engine therefore possessed an immense advantage over that of Savery, and all that had previously been invented. In consequence, however, of Savery having been the first to apply the principle of condensation, it was found requisite by Newcomen and Crawley to enter into an arrangement with him, and accordingly his name was inserted in the patent along with theirs.

[We are sorry we cannot continue these papers oftener, but we wish to *illustrate* the description of every engine, and this causes the delay.—Ed.]

## INTEMPERANCE.

Last, though not least, in the catalogue of esssentials to the increase of moral force, let the poor man be too proud to be a drunkard; or let him be discarded from the society of those who advocate good government and the cause of suffering humanity. Proclaim to the working classes, from morn to night-fall, that no political change can effect the melioration of his condition who is the slave of drunkenness; and add to it this important truth, that political melioration is the resulting consequence of moral progression. With what consistency can that man reprobate the bad government of his country, who practises not good government at home? Or how shall that father reprove his child for immorality, who is himself an habitual drunkard? The vice of drunkenness is that which more especially unveils the deficiency of moral culture in this country. We affect an abhorrence of the crimes of savage life; yet, if whilst exulting in the superiority of our attainments, were we to institute a comparison between the lowest state of savage existence and that of the brutal and confirmed drunkard, our pride might receive a salutary check, in the conviction, that even cannibalism is scarcely more odious than drunkenness. The cannibal exists in a state of moral infancy, in which we discover that entire absence of governing principle,—that absolute freedom of will which has so often occupied the attention of philosophers, and in praise of which, partial knowledge has frequently had so much to say. Unchecked by considerations of humanity or moral feeling—unrestrained by a sense of right or wrong—the cannibal sits down with exultation to the war-feast of victory and joy; and whilst devouring the dead body of his slaughtered foe, constitutes the true representation of freedom of will. In contemplating such a state of savage existence, in such a moral desert, enlightened humanity is shocked at the commission of crimes for which nobody blushes, because they are permitted by all. Nor is this to be wondered at. Living in a state of society in which unrestrained will is the only governing principle—in which he is most reverenced who is most to be feared—in which cruelty is the redeeming virtue, not the odious vice—every external influence operates to produce a character ruthlesss in principle, and cruel in deed. Murder, torture, treachery, and deceit, are among the virtues, not the crimes, of the lowest stages of human existence. Shame, in such a state, has not yet spread its telltale hue over the countenance of man; and a good conscience, the offspring of moral education, is unknown. With no good principle to appeal to—no law to control—what but the most despotic authority could govern a society of individuals such as these? And what principle has the brutal and confirmed drunkard? What law is strong enough to control him? What is his superiority over the cannibal? Is he checked by considerations of humanity or moral feeling, or restrained by a sense of right or wrong, when, daily sitting down to the feast of his cups, he swallows, at each repeated draught, not, indeed, the body of a slaughtered foe, but the happiness and well-being of his wife and children, nor blushes at the deed which consigns them to wretchedness and want? And shall such beings prate about liberty and equality? The liberty they desire is the liberty to do wrong; and to descend to an equality with such individuals, is a degradation to which no honest man will stoop. Herding with society in which unrestrained will is the only governing principle—in which he is most reverenced who is most reckless—every external influence operates to the degradation of the man, and the increase of brutality. Witness the horrid spectacle of the domestic scene. The sound of his foot is the signal of fear,

not of joy. The father that should protect, is coming home to abuse; and the child clings to its trembling mother in a frail, fruitless, but holy effort, to form a barrier of affection between her and brutality. Almost exhausted from the want of a sufficiency of food, half naked, and wholly wretched, the pitiable partner of this human monster sues with fear and trembling for the miserable pittance which his brutal habit has spared for them. This picture of human degradation lacks but one more character to render its odiousness complete—the drunken mother. Then, indeed, the cup of domestic wretchedness is filled to the brim, and poverty, disease, and crime, are secure of their victims. If humanity is shocked at the supposed existence of such wretchedness, what must be the state of feeling on contemplating the reality? Drunkenness is the crying sin of this country, and its debasing consequences are manifest in thousands of instances, in the poverty and immorality of its victims.—*Detrosier.*

## METHOD FOR FINDING THE WEIGHT OF A SHIP,

### WITHOUT KNOWING ITS MAGNITUDE OR FORM.

The following method for finding the actual weight of floating bodies, suggested itself to the writer (Wm. Walker, Esq., Assistant Mast.-Attendant of H. M. Dockyard at Devonport,) by observing that a 78-gun ship floated deeper in the river Medway, at low water, than at high tide; "I am induced (says he) to publish it, because some persons may have conceived it impossible to find the weight of a ship without knowing her form, magnitude, and displacement. I am, however, of opinion, that the following is the only true method by which the actual weight of a ship can be ascertained: it is by this, weighed as by the hydrostatic balance.

"*Ex.* 1. A ship at London had her water-line marked very exactly, and a certain quantity of the Thames water weighed 1000 lbs.: on the ship arriving at Sheerness, it required 25 tons additional weight, to bring her down to her water-line marked at London; a quantity of the water in which she floated, equal to that weighed at London, was found to weigh 1026 lbs.; required the weight of the ship in air when she left London?

"Floating bodies displace a quantity of fluid, equal in weight to themselves. By this principle, the displacement at London and Sheerness, although different in quantity, was equal in weight to the ship; therefore the difference of displacement, in the two fluids, bore a certain ratio to the whole: this difference was equal to 25 tons. It was also found, that a certain quantity of the river water weighed 1000 lbs., and an equal quantity of sea-water 1026 lbs.; therefore their difference, 26 lbs., will be to 1000 lbs. as 25 tons to the weight of the ship in the atmosphere. As 26 lbs.: 1000 lbs.: : 25 tons = 961 tons 10 cwt. 3 qrs. 2-four twenty-sixths lbs.

"*Ex.* 2. The line of floatation of a yacht was carefully marked in salt-water, a certain quantity of which was found to weigh 103 lbs. imperial; the vessel was then moved into a river, and seven tons ten hundred weight was taken out of her, to bring her to the line of floatation marked at sea. A quantity of the river water, equal to the salt water weighed before, was found to weigh 100 lbs.; required the weight of the yacht in the atmosphere, and her displacement, in cubic feet, at sea, supposing a cubic foot of sea-water equal to 64 lbs.?

| | Lbs. | | Tons. Cwt. | | Tons. | |
|---|---|---|---|---|---|---|
| As | 3 : | 100 : : | 7 | 10 = | 250, | the weight of the vessel when in the river. |
| As | 3 : | 103 : : | 7 | 10 = | 257½, | the weight of the vessel when at sea. |
| | | | | As 64 : 1 : : | 257½ = | 9012½ cubic feet displaced. |

"*Ex.* 3. A collier's water-line was carefully marked at sea, and a quantity of sea-water was found to weigh 51 lbs. 8 oz. On her arrival at London, 20 tons of coals were taken out to bring her down to her former water-line; and a quantity of the Thames water, equal to that weighed at sea, was found to be 50 lbs.; required the weight of the vessel and stores, supposing her cargo, when complete, to have been three hundred tons?

| | Lbs. | | Tons. | Tons. | Cwt. | Qrs. | Lbs. | |
|---|---|---|---|---|---|---|---|---|
| As | 1.5 : | 50 : : | 20. = | 666 | 13 | 1 | 9⅓ | in river. |
| As | 1.5 : | 515 : : | 20 = | 686 | 13 | 1 | 9⅓ | at sea. |
| | | Deduct cargo | | 300 | 0 | 0 | 0 | |
| | | | | 386 | 13 | 1 | 9⅓, | wght. of the vessel and stores." |

—*Papers on Naval Architecture.*

## STEAM BOILERS.

*To the Editor of the* Penny Mechanic.

Sir,—If you will have the kindness to insert the following in your very valuable work I shall feel greatly obliged, as I wish to point out a few inaccuracies in Mr. King's sketches and remarks upon feeding boilers.

The remarks of Mr. Puttich, p. 124 in No. 16, are very correct as it regards the pressure of steam in the boiler, forcing up the water valve shown by Mr. King in No. 9. Although his sketch is by no means correct; for if you observe, he does not tell us, neither does Mr. King in No. 21, what becomes of the water forced by the feed pump after their cocks in the service pipe to the boilers are shut, which they of course are when the water is of sufficient height in the boilers. Mr. King's suggestion in fig. 1, No. 9, is by no means new, because it is very similar to the old way of supplying low pressure or condensing engines. If your readers turn to your double number, 13 and 14, and compare the two drawings, they will find them very similar as it regards the float, the steel yard, and valve. It would be as impossible to fill a boiler, in the manner Mr. King states in fig. 1, No. 9, as it would be to keep steam up without fire. Whatever power the pressure of steam is on the square inch in the boiler you must have a greater power to force the water in to overcome the resistance of steam. What power has Mr. King in his small cistern of water on the top of the pipe F to overcome the resistance of perhaps 30 or 40 lbs. pressure on the square inch in the boiler. I can assure you, and I defy any practical man to contradict me, that not only would his cold water be forced away, but the pressure of steam in the boiler would force all the water out. If you turn to your drawing, p. 104 in your double number, you will find in *low*-pressure engines they are obliged to have the pipe (which Mr. King in No. 9 fixes on the top of the boiler) very high. As some of your readers may not know the reason of this, as your correspondent has not mentioned the subject, and also as I wish to convince Mr. King of his error, allow me to state it. The weight of the column of water on the square inch at the lower end of the pipe, where the water comes into the boiler, must always exceed the pressure of steam on the square inch in the boiler, or the steam would force the water back. As low pressure or condensing engines are seldom marked at more than 6 lbs. pressure on the square inch these columns are generally about 14 or 15 feet high. It is for this reason that feed heads, which is the name for these columns, cannot be used for high pressure engines, because, if you work a boiler at 40 lbs. pressure on the square inch you would require a column about 65 feet high.

The usual method, therefore, of supplying high-pressure boilers is by a feed or force pump worked by the engine. There are various ways of regulating the supply of water to the boiler, so as to keep the required height, one of the best of which, if you deem it worthy of insertion, I shall be happy to forward you; it is not an idle supposition like Mr. King's, *as we have it at work daily.* As we are obliged to use a pump for high pressure engines you will immediately see the truth of my question to Mr. King; which is, when the cock under the small cistern in No. 21 is closed, there being sufficient water in the boiler, where is the water to go which is being pumped by the feed pump of the engine? if there is no outlet, you would either break your pump or the connexion of the pump to pieces. If he makes a waste pipe similar to his drawing H in fig. 1, No. 9, he must recollect, should his engine stop when the cock is partly open, the pressure of steam in the boiler will send all the water in the said boiler up the pipe D in No. 21, through the cock and through the waste pipe as shown by H in No. 9, let his holes in the pipe be ever so small. One remark in conclusion,—I say, if the engine *stops* when the cock is partly open, because while the engine is at work the power with which the piston of the pump is forced down counteracts the pressure of the steam on the square inch in the boiler. There are other remarks I could make on fig. 2, No. 9, the force pump No. 20, and also his drawing in No. 21; but I will not take up more of your valuable time. Should you feel inclined to insert this, I will forward you the sketch I promised above, and am, sir,

Your's most respectfully,

CHARLES J——S.

*Somers Town, March 20, 1837.*

## RESULTS OF MACHINERY.

*To the Editor of the Penny Mechanic.*

Sir,—Your impartiality in inserting in the columns of your valuable periodical, the letters both *pro* and *con*, on the interesting subject of the results of machinery, induces me to hope that my view of the matter may meet with the same favour.

With the writer who stated the objections to machinery I partly agree; but with the answers to those objections, by the writer in your last number, I wholly dissent.

To instance one of the propositions, by him adduced, as an answer to those objections, mentioned in the first letter, will answer my purpose; he says, that as machinery has enabled the master manufacturer to dispense with a portion of labour there has been a consequent saving, not to such person individually but to the community in general, but who, I would ask, does not see that in the present state of society and politics the saving would go to give an increase to the comforts and luxuries of such manufacturer, and not in the remotest degree to meliorate the condition of the toil-worn labourer.

Though I am not, either in practice or theory, a machinist, I am in *heart* an admirer of the progression of mechanical science; and as such, if I were able, I would vindicate the right of the millions to participate in the benefits it confers.

What are the discoveries of the powers of machinery but an application of principles eternal in their duration and immutable in their character, made for no man nor class of men but universal in their adaptation, of equal benefit to all? Paine says, "the principle by which the lever acts is a thing distinct from the instrument, and would exist if the instrument did not; it attaches itself to the instrument after it is made." Did the elasticity of steam exist before a Watt or any body else applied it mechanically?

Seeing that these questions must be answered affirmatively, why should a particular caste assume to themselves the exclusive right to the benefits arising from the application of these principles? yet it is lamentable that this is a view of the case that seldom opens on the visions of men; nay, this would militate against the fact, the intolerable fact, that the millions are considered to be, as Rowland Detrosier emphatically said, "human machines for the creation of wealth, whose physical education in the adaptation of their power to mechanical purposes is all that is thought of."

I am, Sir, an Admirer of science,
but an Hater of exclusiveness.

March 19, 1837.

## HILL'S ROTARY PRINTING PRESS.

*To the Editor of the Penny Mechanic.*

Sir,—In Lardner's Cyclopœdia "Manufactures in Iron and Steel," vol. 2, p. 219, will be found the following account of a method of printing exactly similar to Mr. Hill's, and which, as the extract will show, was invented by Mr. Nicholson.

"So early as the year 1790 Mr. Nicholson obtained a patent for a machine for printing on paper and other substances by a more neat, cheap, and accurate method than by the presses at that time in use. His plan was to cast the letters, &c., tapering on the shank, or in other words, as the segment of a circle agreeing with the periphery of a roller, upon the surface of which these types are to be firmly imposed in the same manner as common letters are imposed upon a flat stone. He likewise applied the ink or other colouring matter to his types by means of stuffed rollers or cylindrical brushes. On these accounts he is considered by some persons to deserve the credit of having first suggested the idea of that system of machine printing now under notice, &c."

From the above extract it appears quite clear that this method is by no means so new as I first was inclined to think.

By the insertion of these remarks and the extract, you will oblige, sir,

Your's truly,

C. D. T.

March 25th.

## PERPETUAL MOTION.

*To the Editor of the Penny Mechanic.*

Sir,—Permit me to offer a few remarks to prove the fallacy of J. W. Ritchie's plan, (which I observe in No. 20 of your magazine,) of obtaining perpetual motion by means of springs. H. says, that "he does not intend it should supersede the power of *steam*, but that it really would be useful to turn a coffee mill or draw water;" but so far from doing either, it would not move at all! the two springs would find an equilibrium of pressure and then be steady. What is to move one down? exactly the same amount of power of one spring could not overcome exactly the same power of resistance of the other, for it is an axiom in mechanics, that the moving power must always be greater than the amount of power it is required to communicate to overcome its own friction and the friction of the machinery it moves, hence perpetual motion can NEVER be mechanical. Mr. Ritchie's plan may be compared to two men knocking each other down as they become weak and strong alternately, the stronger knocking down the weaker, as it is precisely on the same principle.

Trusting that the truth of these remarks will at once show the fallacy of J. W. R.'s suggestion, and at the same time that it will obtain a place in your magazine.

I remain, sir, your's, &c.
Brack's Brother.

## LAND SKATES.

*To the Editor of the Penny Mechanic.*

Sir,—With your leave I wish to state a few words respecting the Land Skates. In due respect to Snubby Gong, with his natural kindness of disposition, and W. D. with his impossibility as to their being able to turn or support a man's weight; these two gentlemen will be pleased to pardon me—they are both wrong—and H. Baker, in the theory he advances, is quite correct, yet there is a misfortune in it for him, which is an invention of eight or ten years standing of the same description of skates, that were sold by the inventor somewhere in Piccadilly; and many of your correspondents, I have no doubt, if they have been at all play-goers, may bring to their recollection a Dutch frost scene, which was exhibited on Covent Garden stage, in a pantomime, a few years since. In this scene was much skating, which was dexterously performed on these said land skates; their turning seemed to be accomplished by lifting one foot and turning it, whilst the other runs forward. I have also seen them in streets, on pavement; but the reason they are not generally used I know not.

Your's, obediently,
Strand, March 27th. A. R.

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Mr. Editor,—After so much discussion on the subject of Land Skates, allow me to refer your readers and correspondents to the article "Skating" in the British Cyclopœdia, or in Hebert's Mechanics' Cyclopœdia, now publishing, H. Baker, W. D., and Snubby Gong, will there find that they have been making "much ado about nothing."

March 25th. Rectifier.

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*Patents in America.*—By an official document laid before Congress, it appears that no less than 6000 inventions have been secured by patent since the establishment of the Patent Office in 1793. The plough has been made to undergo 124 improvements; 119 threshing machines have been invented. That great problem, the extraction of butter from cream, without fatigue to the operator, has been solved in 80 ways by the inventors of eighty churns; and the laundress has been allowed her choice out of 125 machines; 123 machines have been invented for making nails; the number of new spinning machines exceeds 100; the number of improvements in the loom is 73; and in the manufacture of hats 43; the number of steam-engines exceed 100; that of stoves is nearly the same; there have been 42 new ways contrived for manufacturing combs; 4 new machines for paring apples have been invented, and 3 gridirons; pencil-cases, ramrods, razors, and suspenders have each been subjected to various improvements. An invention has been patented under the name of "dog-power," another termed an "elevator of pots and kettles," and a third, destined for a useful domestic purpose, under the very sonorous Greek name of "Haemagalactophorus." —*Repertory of Patent Inventions, March* 1832.

*Greenwich Railway.*—The number of persons who have travelled on the Railway during the past week has exceeded the most sanguine expectations of the proprietors. On Monday alone upwards of 10,000 persons passed to and fro from Greenwich and London. We have not heard that any accidents occurred.

*Oil for delicate Machinery.*—The oil for diminishing friction in delicate machines ought to be completely deprived of every kind of acid and mucilage, and to be capable of enduring a very intense degree of cold without freezing. Chevreul's process consists in treating the oil in a matrass with seven or eight times its weight of alcohol till boiling. The liquid is then to be decanted and exposed to the cold; the *stearine* will then separate from it in the form of a crystallized precipitate. The alcohol solution is afterwards to be evaporated to a fifth part of its volume, and the *elaine* will then be obtained, which ought to be colourless, insipid, without smell, and incapable of altering the colour of the infusion of litmus or turnsale, and having the consistence of pure white olive oil.

*Cement for rendering Joints Steam-tight.*—The following receipt forms a strong and durable cement for joining the flanches of iron cylinders of steam engines or hydraulic machines:—Mix boiled linseed oil, litharge, red and white lead together, to a proper consistence, always using the larger proportion of white lead. This composition may be applied to a piece of flannel and fitted to the joint. Cisterns built of large square stones, and put together with this cement will never leak. A more powerful cement for withstanding the action of steam, composed in the proportion of two ounces of sal ammoniac, and four ounces of sulphur, made into a stiff paste with a little water. When the cement is wanted for use, dissolve a portion of the paste in water rendered slightly acid, and add a quantity of iron turnings or filings, sifted or pounded, to render the particles of uniform size. This mixture, put into the interstices of iron work, will, in a short time, become as hard as stone. From experience, it is ascertained that more depends upon caulking the joints than in mixing the cement.

## INSTITUTIONS.

LECTURES DURING THE WEEK.

*London Institution.* Finsbury Circus.—Monday, April 3, at 1 o'clock, afternoon, R. Bond, esq., on Physical Geography.—Thursday, April 6, at seven, H. J. Gauntlett, esq., on Ecclesiastical Music.

*London Mechanics' Institution*, Southampton-buildings, Chancery-lane.—Wednesday, April 5, at half-past eight, Dr. Grant, on the Molluscous Classes of Animals.—Friday, 7, Mr. Foggo, on Taste in Literature and the Arts.

*Aldersgate-street Institution*—Wednesday, April 5, at eight, H. Goadly, esq., on the Anatomy of Insects, illustrated by the oxyhydrogen microscope.

*Islington Literary and Scientific Society.*—Thursday, April 6, at eight, G. F. Serjeant, esq., on the Political, Moral, and Religious, state of Spain.

*Bermondsey Mutual Instruction Society.*—Monday, April 3, at quarter past eight, Mr. Gregory, on Botany.

*Mutual Instruction Society*, 16 Great Tower-street.—Monday, April 3, at eight o'clock, Mr. Robinson's Introductory Lecture on Chemistry.

## QUERY.

LOGARITHMS.—Can you inform me of some of the latest works upon this subject?—R. W.

[Babbage's Table of Logarithms of Numbers, royal 8vo., 10s., coloured, 12s. Babbage's Table of Logarithmic Sines, &c., 8vo., 15s. Babbage's Sines and Tangents to do., royal 8vo., 12s.—ED. P. M.]

## TO CORRESPONDENTS.

"John Gregory." We are gratified to learn that our notices of his inventions have been the means of introducing him to gentlemen who have been of service to him 2. Address "To the Lords of the Admiralty." 3. We think the machine should be made of full size. 4. "The Rotary Pump" shortly.

"Snubby Gong." The name was mistaken by the compositor. We do not, however, suppose that there are any *classical* associations connected with it, and therefore that the alteration is of very great importance.

"A Constant Reader." The terms of subscription to the Western Literary and Scientific Institution are two guineas per annum, with 10s. 6d. admission fee.

"A Reynolds." The paper and drawings of the "Velocipede," or Dandy Horse, shall be attended to.

Received "A. C. R.," "M. M.," "A Mechanic," and "N. S. N."

"A Lover of Science." There is a good deal of misunderstanding about the word, and we and our Correspondent certainly attach different ideas to it.

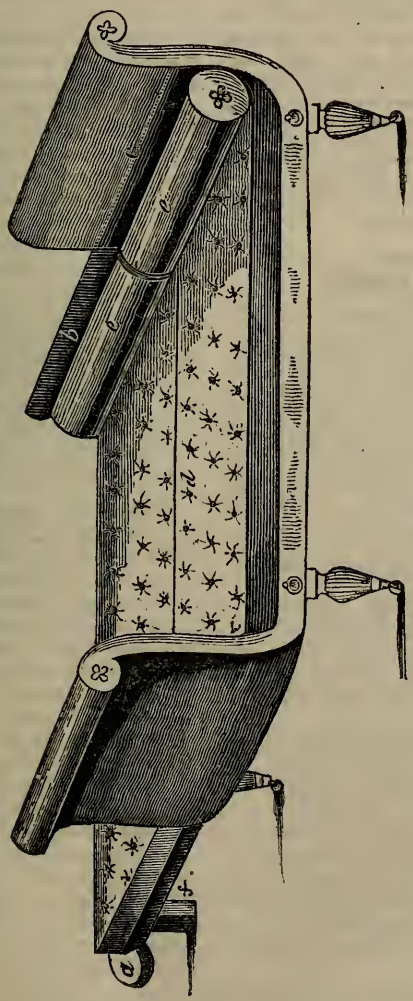
Books for review, and communications for the Editor, to be left, addressed to him, at the Publisher's.

London: Printed at the Holloway Press, by D. A. DOUDNEY; published by BERGER, Holywell-street, Strand; and may be had of all Booksellers.

# THE PENNY MECHANIC.

A MAGAZINE OF ARTS AND SCIENCES.

No. XXIV.] SATURDAY, APRIL 8, 1837. Vol. I.



F. MONDAY'S SOFA BEDSTEAD.



Holloway Press: D. A. Doudney.

*To the Editor of the Penny Mechanic.*

Sir,—The following is a description of a Sofa Bedstead, which you will perhaps think worthy of a place in your valuable Magazine. *a*, the back, hinged, to let down to form the bedstead; *b*, a thin headboard, made to slide in a groove in the direction of the dotted lines *c*, which must be fastened to the back with an hook and eye; *f*, one of the *three* feet, to support the back; *g*, the mattress, which is made to fold to form the cushion for the sofa; *ee*, the pillows of the sofa, to form the bolster for the bed; *h*, the back rail; *i*, one of the feet, made with a joint, the same as a common bedstead, which is kept in its position when open by an hook and eye; *k*, another of the feet, shut in the rail, the same hook serving as a fastening.

Your obedient Servant,

F. Monday.

London, March 6, 1837.

## MANUFACTURES.

### NEEDLE MAKING.

We intend, from time to time, to publish short descriptions under this title, of the manner in which our various domestic implements are manufactured, and also to make more generally known many processes connected with the arts that we think will be entertaining and instructive to our readers. A poet has said,

"To know
That which before us lies in daily life
Is the true wisdom."

And certainly the time employed in making ourselves acquainted with the history of instruments we are using every day, or of processes that we are constantly practising, will not be time misspent.

We have no reason for adopting any particular order for these papers, and have therefore taken for the first the manufacture of needles, both because it is a subject on which most of our readers will feel some interest, and also because Mr. Donavan, in his Treatise on Manufactures in Iron and Steel, has given so full and excellent a description of the process, that we can depend on him for our materials.

"English chroniclers record that 'the making of Spanish needles (as the fine sewing-needles were formerly designated) was first taught in Englande by Elias Crowse, a Germaine, about the eighth yeere of Queene Elizabeth; and in Queen Marie's time there was a negro made fine Spanish needles in Cheapside, but would never teach his art to any.'

"Although at present the needle trade in this country is not by any means so localised as might be supposed, the places most noted for the manufacture are, Whitechapel, in London; Redditch, in Gloucestershire; and Hathersage, in Derbyshire.

"The first process in needle making is *cutting and straitening the wire.*—A coil of soft, clean steel wire is cut with a pair of large shears, into lengths of four or five inches; each piece of wire will make, when again cut, more or fewer needles according to the size intended. These lengths are then bundled together by being bound round as compactly as possible by two iron hoops or rings about four inches in diameter; in this state the bundle is placed upon a cast-iron table, and a slab of iron about two feet in length, and broad enough just to fall between the rings, is placed upon the wires, and the bundle rolled backward and forward, the workmen pressing with the lever until the wires become perfectly straight. This operation, which is called rubbing, straightens the lengths perfectly.

"*Pointing.*—Needles of all sorts are pointed upon small grindstones running dry; between one and two dozens of the lengths just mentioned being applied at once with great dexterity by the grinder, each wire revolving while in contact with the stone. In consequence of the minute particles of steel which are evolved in a cloud during this operation, and which are necessarily inhaled by the workmen, needle grinding is found to be an employment extremely prejudicial to health. Of late years, however, various devices have been adopted for diminishing the evil, such as hanging a cloth over the stone, so as to draw off the greater part of the pulverulent atmosphere, wearing damped gauze over the mouth, or by placing a mask of magnetic gauze before the face, so that the floating metallic particles are arrested and detained; the needle pointers, however, like the fork grinders, who suffer dreadfully, and often fatally, from the same evil, manifestly exhibit rather a reluctance than a forwardness to adopt any pre-

ventative which seems to be an incumbrance, and which they oddly enough fancy might tend to abridge the amount of their earnings in the ratio that it should diminish the deleterious nature of their occupation. 'Because,' say they, 'if our work were less injurious, our masters would reduce the price of grinding.' The wire, when pointed, is again cut with shears into bits of the exact length of the intended needle.

"*Eyeing and Filing.*—To perforate a bit of exceedingly fine steel wire, so as to produce the eye in a needle hardly the thickness of a hair, must obviously require a hand possessing at once considerable delicacy and dexterity combined. The person, generally a female, performing this operation, first slightly flattens with a small hammer that end of the needle intended to receive the eye; she then places it upon a little anvil which is fixed in her work-bench, and by means of a stroke with her hammer upon a delicately-pointed steel punch makes an indentation on one side; she then places it upon a block of lead, and by a similar stroke with the same instrument completes the perforation. The needle is in the next place detained in a pair of pliers, and the head being bent back a little, it is, by means of a suitable kind of file, made to receive that peculiar channel or gutter which is observable on each side of the eye; this guttering, as it is called, is performed with amazing precision and dispatch by some women: a smooth file is afterwards applied upon the head of the needle. These processes are generally conducted by outworkers—women and girls at their own homes, and are mostly confined to the more delicate articles. The larger needles are brought more directly under the operation of machinery. For instance, the formation of the gutters and the piercing of the eye, are made to depend upon strokes given by a stamp and a fly press. In the former process, a piece of wire of the length of two needles, and pointed at both ends, is placed exactly in the middle upon a steel die having the form of a gutter, &c. impressed on its surface: over this die hangs another, its exact counterpart; so that by means of a blow from the stamp hammer, the two needles between the dies are exactly impressed on both sides with the channels already mentioned. The piece of pointed wire is then in a similar manner placed under a fly press, where, by means of two steel points falling over corresponding holes in a die, the two eyes are instantly pierced with great precision. These needles are then broken asunder, and the heads corrected with the file, as in the former case.

"*Soft Straightening.* — During the foregoing operations the needles have severally become more or less crooked, especially in the guttering by hand, when the head is pushed or bent backward and forward for the convenience of the file. To correct this defect, the needles are placed in files on a smooth metal plate, and by means of a piece of smooth iron, like that above described, they are rolled until they become severally quite straight.

"*Hardening and Tempering.*—The needles are placed, several thousands together, in a cast iron receptacle; and, after being covered over with ashes, to prevent oxydisation, they are submitted to the heat of a close furnace, until reaching a cherry red, the vessel is withdrawn, and its contents dropped into a tub of cold water; they are then collected from the water and placed upon an iron plate, kept nearly red-hot by means of a fire underneath. Upon this plate the workman, by means of two little iron shovels, keeps turning the lot of needles inside out, as it were, so as to allow the effect of the heat to take place upon them all equally. As soon as the blue oxydisation makes its appearance the needles are considered of the proper temper, when they are instantly removed, with singular dexterity, by means of the two spatulæ just mentioned.

"*Hard Straightening.*—As almost all kinds of steel articles, if light and slender, are found to suffer some alteration of shape during the process of hardening, so needles, in this stage, are more or less warped or bent; they are severally, therefore, straightened by means of two or three strokes from a small hammer on a little anvil fixed in the work-board for this purpose. They are now ready for

"*Scouring.*—This operation, requiring considerable force, is in all cases performed by water or steam power. The needles are placed neatly one over the

other, many tiers deep, and in parallel rows, upon a piece of stout coarse cloth smeared over with oil, soft soap, and fine flour emery; the cloth is then rolled up, so as to enclose the needles, much in the same way as certain Yorkshire housewives are in the habit of interlaying preserved fruit in lamina of paste for family dumplings: the rouleau is now tied about firmly, throughout its length, with strings. In this state several rolls, each containing 40,000 or 50,000 needles, are placed in a machine, exactly resembling an ordinary mangle, *i. e.* upon a board, over which is made to move backward and forward, by means of a crank, and making ten or twelve movements in a minute, a weighted box of an oblong shape. In this manner the needles are rolled one against the other, amidst the emery, for from two to three days; two or three wrappers being completely worn out, and the needles transferred to others, during that time. Out of the last of these wrappers they come perfectly clean and bright.

## RESULTS OF MACHINERY.

*To the Editor of the Penny Mechanic.*

Sir,—I am heartily glad that the letter I addressed to you some short time since upon this subject, has had the effect of drawing forth a champion of the opinion that the introduction of machinery has not been more injurious than otherwise to the *working classes*, because we can now ascertain what are really the opinions of the persons he represents. I am glad "J. B." has been kind enough to state his views upon the question, but I am sorry he has come to a conclusion so plainly contradicted, I think, even by his own letter. He states two propositions; first, that machinery has increased, not diminished the demand for labour; secondly, that machinery by lessening the cost of production of most of the necessaries and many of the luxuries of life, has greatly increased the means of enjoyment of the people—ego! machinery has been more beneficial than otherwise to the working classes. Now, without attempting to answer either of these propositions, without in the least degree questioning their accuracy, I submit that the statements contained in my letter remain unshaken. I still maintain that whenever a machine is introduced into any art or manufacture, it deprives the workmen who had previously been engaged in such employment of their means of subsistence, and therefore, although it may cheapen, as it undoubtedly does, many of the conveniences and comforts of life, yet as it lowers the wages of the workmen, it deprives them of the means of enjoying the advantages it bestows. Whether I state the case truly or not, let the hand-loom weavers, and the other classes of workmen who have been thrown out of employ by the introduction of machinery—let them answer. It appears that even your correspondent himself could not completely shut his eyes upon "what is really the state of the case," for he says no one ever denied that the introduction of machinery injured particular trades. What more, then, is wanting to prove my statement? What more is necessary to show the invariable tendency—the invariable result of machinery? J. B. would wish it to be thought that only a few persons in any particular trade are injured. He says, "Compare the number of hand-loom weavers and others who have been injured, with those who have been benefitted by machinery, and the injured will be seen to be exceptions to the rule." This is merely an assertion, it is not supported by any kind of proof; on the contrary, we have parliamentary reports, as well as individual experience, which tend to a conclusion directly opposite. If therefore your correspondent thinks he has answered my proposition, I must beg him to peruse my letter again, and he will then see that in order to do so he must show that machinery has not deprived workmen of their employment—has not lessened their rate of wages—and has not therefore been productive of misery to a very great majority of the working classes. When he does this I will willingly admit that the case is very different to what I at present believe and have affirmed. But till he does this my proposition remains unanswered.

I am anxious that the view I take on this matter should be placed beyond dispute, because, if I am correct, it is evident that a tax should be imposed on machinery for the benefit of the working man, or some other effectual means adopted, to prevent the destitution and misery to which *he* is now subjected, whenever machinery interferes to deprive him of his means of subsistence.

Yours, most obediently,

S.

27th March, 1837.

*To the Editor of the Penny Mechanic.*

SIR,—I beg to state to your correspondent, Mr. Rough, that spirits of wine boil several degrees below 212°, which is the heat of boiling water, so that it is obvious that spirit could not be preserved in the manner described page 164, as the case containing the spirits would burst long before the water boiled. If your correspondent wishes for a demonstration of this, let him put a little spirits of wine in a phial, and hold it in water; let him then make the water boil, and he will soon find that the water will boil long before it.

J. R. HATTS, M. D.

## A PLAN FOR EXTINGUISHING FIRES ON BOARD SHIPS.

THE instrument alluded to, for the purpose of admitting water into a ship, is formed on the principle of the syphon. A bent copper tube, one foot in diameter, is placed through a port, having one arm outside the ship extending to a small depth below the water's surface; the other inside, passing through the gun-deck and orlop, to the lower part of the hold. Let the instrument thus placed, be supposed filled with water, and the two orifices closed; if they be then unclosed, the water will flow out at the orifice inside the ship, which is at a considerable depth below the water's surface, whilst the pressure of the atmosphere, forcing the fluid through the tube from the outside, will cause a constant stream to be maintained as long as may be required. Two valves are fitted closely over the orifices, which may be opened or shut by rods fixed to them, and brought up to the part of the instrument which rests on the portsill. These valves are for the purpose of more conveniently filling the instrument; and, by their means, its action may be made to commence or cease at any instant. It will be further necessary to immerse the orifice in the hold, a few inches, in a vessel of water, to prevent the admission of any particles of air, which may otherwise penetrate into the tube, at this place, in so considerable a degree, as eventually to stop its action.

It is suggested that an instrument of the kind be supplied to all ships. If, in ordinary, it be fixed in the above position, and filled with water (the valve inside the ship being shut, and that outside open, and secured back), this precaution will cause whatever leakage takes place at the inner valve to be supplied, and, at the same time, furnish a constant test to ascertain the state of the instrument. On discovering a fire to have commenced, the person on board has only to open the valve in the hold, by means of the rod brought up to the portsill, when the instrument will instantly be in full action. The adjoining ships, in the mean time, should send their syphons in their boats, and dispose them as quickly as possible through any port the fire will permit; for which purpose, every facility may be afforded in the disposition of the spaces left in the decks for the circulation of air. Thus the ship may be rapidly sunk to her portsills; the syphons then stopped, by closing the outer valves: and thus all the difficulty and expense of raising the bottom will be avoided.

Whilst the ship is being sunk, it will be necessary to plug up those holes with which some of the planks in the buttocks are usually perforated, for the admission of air; at the same time, the gun-deck scuppers must be also plugged, and the gun-room ports and air scuttles in frigates caulked.

It is presumed, the above instrument may be admitted to combine the following advantages:—

1. Simplicity; including the trifling expense of its construction, and the great improbability of its getting out of order.

2. The facility with which it is put in operation, and the continuance of its action without manual labour.

3. The power possessed of stopping its action at an instant; by which means, the expense of raising a ship in harbour is saved, and a security afforded against the effects of accident.

It is further proposed, that a few alterations be made in the orlops of ships of the line, and lower decks of other ships, so as to render these decks capable of being entirely covered with water. Another syphon, with its inner orifice just above these decks, must be also supplied, for the purpose of admitting the water, in the event of fire. With these arrangements, on an alarm of fire, the orlop or lower deck

may be immediately converted into a reservoir of water, which it is conceived will interpose a complete barrier to prevent the communication of the flames from the hold to the upper works, or from the upper works to the hold. On this supposition, if the fire should have commenced in the hold, by thus preventing it from extending upwards, whilst the hold is being rapidly filled with water, it will be shortly extinguished, with the loss of the works in the hold alone. The importance of this is considerable, even in ships in ordinary; but how greatly is it increased in ships at sea, if it is considered that those fires, which are usually most fatal, might be thus, with great probability, extinguished, and the loss of many valuable lives prevented.

Supposing the fire to have commenced on the decks of a ship in ordinary, she may be sunk till the gun-deck is below the water's surface, and covered with water; when the syphons should be stopped, taking care to plug up the scuppers. Thus the whole of the ship below the gun-deck sills may be preserved, whilst the usual means are resorted to for saving the top-sides.

In a ship at sea, under the above circumstances, the crew should take to the boats and spars, and, whilst the ship is being sunk by the syphons, exert every possible means to preserve the gun-deck till it is sunk below the water's surface, and covered as described above. This deck, when the fire shall have burnt out, will answer the purpose of a raft; and if the pumps are uninjured (for which purpose every thing connected with them should be of metal), the crew may be able to get to the provisions, and in favourable weather may, perhaps, in many instances, be saved.

The alterations necessary, in the orlops and lower decks of frigates, must be now considered. In frigates and small vessels, nothing further will be necessary, than to have the comings round the hatchways and mast-partners of sufficient height. On the orlop decks of ships of the line, besides the height of the comings, a cant must be fixed at the after part, to prevent the water from flowing into the bread room; the wing gratings substituted by solid scuttles, and perhaps the plank under the cable tier may be half an inch thicker, to allow of its being caulked. Ships in ordinary will also require cants to be fixed round those spaces left in the decks for the admission of air. It is presumed, the expense and inconvenience produced by these alterations would be inconsiderable.

It would be very advantageous to have, at least, two athwart-ship bulkhead caulked with penstocks in the limbers, capable of being screwed down from the gun-deck; by which, a fire below would be extinguished much more rapidly, and with much less injury to the provisions and stores.

The hold of a three-decked ship in ordinary, it is considered, may be filled by sinking her not more than 5 feet 10 inches. This space will diminish with the class of ship: in a ten-gun brig, not more than 2 feet 3 inches will be requisite. It is manifest how considerably it will be diminished when the stores and provisions are stowed. A 74-gun ship, in ordinary, will require about 1,300, tons of sea-water to fill her hold; and, supposing her fitted with a syphon of each kind above described, this may be accomplished in less than two hours.

## PERPETUAL MOTION.

*To the Editor of the Penny Mechanic.*

Sir,—In Number 23 of your most valuable work, your correspondent "Brack's Brother," takes rather a difficult task upon himself to prove the fallacy of my Perpetual Motion which appeared in Number 20. He says it would not move at all; but I suppose he will allow one to know who has proved it with success. The two springs are not to be of equal strength, and the fly-wheel goes very far; so therefore my plan you will find is quite correct. I should be much obliged to "Brack's Brother," to form a model and try the experiment, as I have myself done.

Yours, truly,
J. W. Ritchie, Junior.

April 4, 1837.

## MECHANICS' LIBRARY.

*The Producing Man's Companion—State of Society in England. By Junius Redivivus.* Effing. Wilson.

We have seldom perused a book with greater satisfaction than this. Unlike many works that are written for the purpose of instructing those who are condescendingly spoken of as the "poorer classes," the one before us is written in a manly, generous spirit, as a man should write who wishes to make the knowledge he is possessed of useful to others, without rendering its acceptance in any way humilitating. Such unfortunately is not the style always adopted by those who write works similar to the "Producing Man's Companion," but "Junius Redivivus" is a sincere friend of the working man, and he has addressed him as such. The volume contains a very lucid exposition of the principles of Political Economy, more particularly as they affect the well-being of the working classes. After considering the present condition of society, and the numerous evils, both social and political, under which this class of society at present labours, he points out, at some length, the best means he can suggest for remedying the evil. There can be no doubt that the remedy must be obtained —must be proposed and carried into practice by the working classes *themselves;* and, when we consider what they have already accomplished, we look forward with a pleasing certainty that the time will arrive when the desirable object shall be obtained. Junius Redivivus maintains the opinion that an over population exists—that the number of consumers is greater than the supply of food, and that consequently some must starve, or a great number be obliged to submit to receive an insufficient quantity of food, in order to prevent such an occurrence. This is the case at the present time.

"The lover of his species will lament over this horrible reality, and ask, if it must go on for ever—if there are no means of preventing so much misery? The answer is, yes; education will remedy all; —not that which is commonly called education, the mere tools of knowledge—reading and writing; but the development of the reasoning power which all human beings possess in a greater or less degree; the bringing forth of mind, and teaching it the exercise of thinking. Shallow persons cry out against education, as tending to unfit human beings for the laborious and drudging duties of life. More interested persons cry out against education, because it is the means of bringing forth latent intellect, which will push them from their stores of idleness, and force them to fresh exertions, in order to retain their places as men in authority: for they well understand the axiom of Bacon, that "knowledge is power," and the highest degree of knowledge must reign paramount; so that, were all educated, the present factitious state of the authority of *caste* could not endure. This they know, and as they wish to perpetuate the present state of things, they cry out against education. But such persons as these are prejudiced judges, whom no reasoning could convince, which tends to the overthrow of their selfish interests; therefore, they are not worth notice. But those who really believe that education is mischievous in practice, and tends to unfit poor people for the discharge of their duties, would do well to reflect, that the perpetrators of arsons and other outrages, during a state of public excitement, have been the miserable pauper peasantry—the people without education. It is ignorance alone which resorts to violence; because ignorance, not being able to reason from cause to effect, resorts to blind destruction. What was it which produced the difference between the first and the second French revolution? Why did the population of Paris in the eighteenth century delight in butchery, and in the nineteenth shine forth a race of heroes, brilliant with exalted courage, and at the same time exercising the sublimest traits of mercy and forbearance? The mists of ignorance were expelled by the accumulated knowledge of forty years, gained in the school of experience. That was really education."

And Junius Redivivus considers that, in process of time, if means are taken to improve the mental condition of the people, that as great and beneficial a change will be effected in the minds of the people of this country.

The book is not new, but it is one that we are sure will benefit every person who reads it, whether he agrees or disagrees with the conclusions of the writer. It is written in a vigorous, manly style, very much resembling Cobbett's, and the language used is always appropriate.

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We are informed by a Correspondent that the London and Birmingham Railway will be opened, for a distance of one-and-twenty miles, on the 1st of June next. We wish the promoters of this grand national undertaking every success.

## MISCELLANIES.

*The Lunar Eclipse* on the 30th instant, is likely to be attended by an extraordinary and interesting occurrence. The Eclipse will begin at half-past six o'clock in the evening, and the moon will rise eclipsed at seven o'clock. As the earth must be between the sun and the moon, in order to occasion an eclipse, the sun ought then to be below the horizon; but owing to the refraction of the atmosphere, it is conceived that we shall see the singular phenomenon of the sun remaining *above* the western horizon, while the moon appears eclipsed in the eastern. Such a phenomenon was seen in Paris in 1750.

*Straw Weaving.*—A new manufacture has been introduced into the west of Scotland—the weaving of straw hats. The straw instead of being plaited by the hand, is woven by the loom; the warp employed being a slender thread of silk, which unites the straw firmly together, and produces a very beautiful fabric. It is woven in pieces of twelve yards long, and an inch broad; the one edge exhibiting an ornamental pattern susceptible of infinite variety, and when sewed together and made up into bonnets, the appearance of the whole is extremely pretty, and the cost will not exceed one half of that of tuscan.

*Sting of Bees, Wasps, and other Insects.*—These are seldom fatal; but the pain which they excite is almost insupportable in some habits. Let the affected parts be bathed with tepid spirit of Mindererus.

## INSTITUTIONS.

*Popular Education Association.*—We are happy to have it in our power to direct our readers attention to this association, which we are sure only requires to become more generally known, in order to render it of much service to the cause of popular education. Its objects are to form a collection of diagrams, and apparatus to illustrate scientific lectures; and to provide *Gratuitous* Lecturers to Mechanics' Institutions, and similar associations that may require such assistance. The diagrams, &c. are also furnished to lecturers without any charge. The association has only been established a few months, but already it has been the means of forming several societies and has assisted many others.

### LECTURES DURING THE WEEK.

*London Institution.* Finsbury Circus.—Monday, April 10, at 1 o'clock, afternoon, R. Bond, esq., on Physical Geography.—Thursday, April 13, at seven, H. J. Gauntlett, esq., on Ecclesiastical Music.

*London Mechanics' Institution*, Southampton-buildings, Chancery-lane.—Wednesday, April 12, at half-past eight, Dr. Grant, on the Molluscous Classes of Animals.—Friday, 14, Dr. Ritchie, on Optical Instruments; Double Refraction; and Polarization of Light.

*Eastern Athenæum*, Stepney Square.—Wednesday, April 12, Mr. Deville, on Phrenology, at eight.

*Western Literary and Scientific Institution*, 47, Leicester-square.—Thursday, April 13, at eight, C. Buckingham, esq., M.P., on Palestine.

*Southwark Literary Society.*—Wednesday, April 12, W. Lucking, esq., on Fossil Organic Remains, at eight.

*Islington Literary and Scientific Society.*—Thursday, April 13, at eight, Mr. T. Cromwell, on the Archeology of the British Islands.

*Mutual Instruction Society*, 16, Great Tower-street.—Monday, April 10, at eight o'clock, Mr. Robinson, on Phrenology.

*Bermondsey Mutual Instruction Society.*—Monday, April 10, at quarter past eight, Mr. Gregory, on Botany.

*Finsbury Mutual Instruction Society.*—Tuesday, April 11, at half past eight, Mr. Logan, on Phrenology.

### QUERY.

Can any of your correspondents explain to me why, if the rays of the Sun are suffered to fall on a fire, they will put it out.

W. C. C.

### TO CORRESPONDENTS.

"A. C. R.," who proposes to create a perpetual motion by magnetism, has not stated in what way he supposed this can be effected. The magnetic fluid can only be generated for a certain time without a supply of acid, &c.

We should be glad to receive a fuller description of the Rotary Pump, sent us by "J. G." also, of its mode of working.

"Mr. Reynolds's" request shall be complied with.

"The Method of describing an Oval" *is* worthy a place in the Magazine, but would not, we think, interest the majority of our readers.

"Anthony Morton's" letter on the Results of Machinery, shall be attended to.

Received, "J. W. Ritchie,"—"No Chemist,"—"F. P. C."

If the Secretaries of Institutions will forward us admission tickets for their Quarterly or General Meetings, we will attend and report the proceedings.

Books for review, and communications for the Editor, to be left, addressed to him, at the Publisher's.

ERRATA—Steam Boilers in last No.: for "fill," line 29, read "feed;" for "marked," line 65, read "worked;" for "65," line 74, read "85."

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# THE PENNY MECHANIC.

A MAGAZINE OF ARTS AND SCIENCES.

No. XXV.] SATURDAY, APRIL 15, 1837. Vol. I.

RAILWAYS.

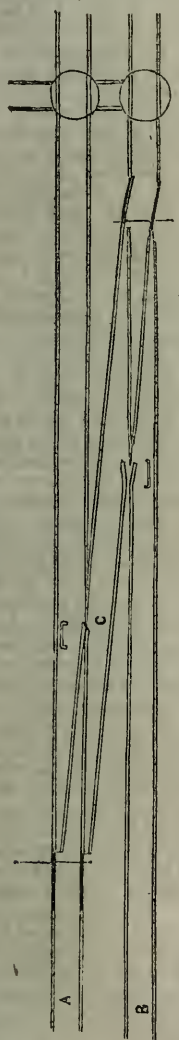


Fig. 1.

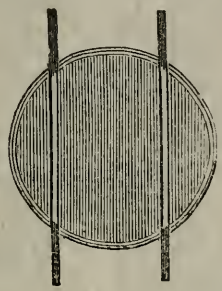

Fig. 4.

Fig. 3.

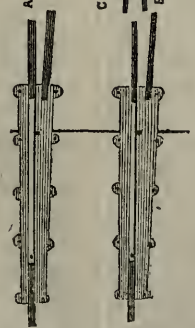

Fig. 2.

Fig. 7.

Fig. 8.

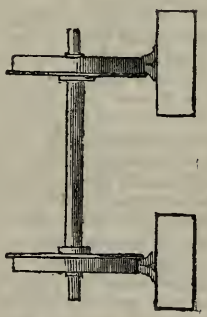

Fig. 6.

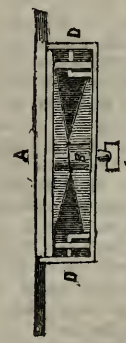


Fig. 5.



Holloway Press: D. A. Doudney.

## RAILWAYS.

NO. IV.

An iron railway is constructed by placing straight bars of iron along its whole length, two of which being placed parallel to each other, form a track, on which the wheels travel; in most public lines, not less than two tracks are used, the one for going, and the other for returning. The wheels used for travelling upon railways, are coupled by means of the axletree, so that the one wheel cannot turn without the other. One wheel runs on each rail of the track, and if both wheels are of the same size, they will continue undeviatingly in a straight line, (Vide Fig. 6.) The wheels are prevented from getting off the track by means of the flanch *a*, placed on the inner edge of the wheel; but if this was to rub against the rails, great friction would be produced, and much power lost; to avoid this, therefore instead of the rim of the wheels being made cylindrical, they are made conical, with their smaller diameters placed outside, and the rails are placed about one inch further apart than the two flanches, now it will be seen by this, that if the flanch of one wheel should get close to one rail, that wheel will be travelling on a larger diameter, while the other will be traveling on a less than they would if each flanch was an equal distance from the rails they are travelling on; (both wheels being connected by means of the axletree) the consequence will be, that one wheel will travel further than the other, so that the axletree will be turned to less than a right angle with the road, (the angle it should always occupy), and thus throw the larger diameter of the other wheel, on the other rail, and thus adjust itself, so that the flanches should never touch the rails; another effect produced by the conicalness of the wheels, is this, it is evident that where there is a turning in the road, the cylindrical wheels would have a tendency to continue in a straight line, and thus get off the rails. Now where there is a curve in a railway, the outer rail will be longer than the inner one, and where a carriage goes round a curve, the centrifugal force, causes the carriages to fly towards the outer rail, which is raised, to counteract it in a measure, but not completely, for then the flanch of the outer wheel, is allowed to approach the outer rail sufficiently to establish a proportion between the difference of the length of the two rails, and the difference of the diameters of the two wheels, and in this case the flanches of the two wheels, seldom or never touch the rails.

It will appear from this, that the carriages on a railroad, will continue in the same track from one end to the other; but it is sometimes necessary to turn the carriages out of one track into another, either that one part of the road may be repaired, or to pass another train going at a different velocity; for this purpose, a crossing is made use of. In Fig. 1, a portion of a railway is shown on purpose to illustrate it; A B represents the two tracks, and suppose a carriage at A, was necessary to be passed into the track B, near A, a portion of each rail is made moveable on a pivot at one end, and connected at the other by means of a rod of iron (fig. 2). Now from the circumstance of a portion of these rails being moveable, they may be made to form either a part of the track A (fig. 1), or part of the diagonal track C, now a carriage wishing to pass from the track A, to the track B, would cause the moveable rails to form part of the track C, consequently, the carriage instead of continuing along the track A, will turn into the diagonal track C. It is necessary that the diagonal track should be exactly in the same plane as the other two; and it will be seen that the two inner rails of the straight tracks, must be cut to let the flanches of the wheels through, at the places where the diagonal rails intersect them, which is represented in (fig. 3), where *a a* and *b b* represent the two rails of the straight tracks and *c c*, one of the rails of the diagonal tracks, the line *a a*, is not intersected in this case, but the two lines *b b* and *c c* do intersect each other, and therefore, the lines *b c*, meet in a point near *d*, while the lines *b c* only approach within a distance sufficient to allow a flanch of the wheel to pass on either side of the point formed by the other two lines, the short rail *e e* is placed to catch the flanch of the wheels, passing in the straight track, to prevent them getting off the rails at the opening of the crossing. It will be seen by (fig. 1), that to render a crossing complete, it is necessary to have a pair of moveable rollers at each end of the diagonal track, similar to (fig. 2), and two points as (fig. 3). The switches or moveable rails, are moved by means of a lever handle by an attendant of the road, whose duty it is to place them in the proper position according to given signals. In (fig. 1) the moveable rails are represented black, and are shown with one pair pointing into the main line, and the other into the diagonal; in fig. 2, the moveable lines, are represented white. Besides these

crossings, it is sometimes necessary to use a turning plate, as it is called, these are represented by two circles at the end of fig. 1, and enlarged in fig. 4; it consists of a round flat plate, fixed upon a verticle axis, across which are stretched the rails, they are only used in the depôts, or where it is necessary to turn a carriage round at right angles very sharply, then the carriage is drawn on to the plate, when carriage and plate are both turned round together. Fig. 5, represents a section of this contrivance, A represents the plate, with the rails affixed, B a cross throng, which the verticle spindle passes, C the pivot of the vertical spindle, the edges of the plate are supported all round by means of friction rollers D; now it will be seen, that it would take a considerable time to pass a train over a turning plate, therefore, they are never used, where one railway joins another, even at right angles, but the adjoining railway is made with a curve at its end, when it enters the tracks of the other rails by means of a pair of moveable switches, similar to fig. 2.

Figs. 7 and 8, represent sections of the rails with their chairs, these rails are rolled, with an uniform section throughout at the present time, but they used to be made, what is called fish-bellied, that is, they were made deeper in the middle, between the two supports, (similar to the belly of a fish) to give them greater strength; but that system is quite exploded, and they are now made of an uniform section. The rail fig 7, weighs 56 lbs. to the yard, *a* is the rail, *b* the chair, which is cast of the shape represented. The rail is dropped in, and a piece of wood *c*, is drove in at the side to hold it firm. Fig. 8, represents a rail 35 lbs. to the yard, but it is not adapted for engines passing over it at a rapid rate, it is formed with an uniform section, and is kept in its chair, by having a feather rolled upon one side, against which an iron key or wedge is pressed; *a* represents the rail, *b* the chair, and *c* the key or wedge, in each rail, the supports are placed 3 feet apart, and the axletrees of the carriages are never placed closer than 4 feet 6 inches, so that the wheels can never rest between the same two supports at the same time.

In these papers, it has not been my object to describe the various transitions which have taken place in the history of railroads, as that would be too tedious, but only to describe the form, in which they at this period exist; upon another occasion I will undertake to describe the Locomotive Engine, and other matters connected with this subject.

E. T. W.

## RESULTS OF MACHINERY.

*To the Editor of the* PENNY MECHANIC.

SIR,—The members of a society to which I belong are much interested in the discussions in your valuable periodical, headed Results of Machinery.—When a shower of rain falls upon a field, the owner thereof has an undoubted right to the benefit of it; so it ought to be with machinery—machinery falleth upon labour which is the prerogative of the working-classes; and they ought to receive the most benefit from it. I maintain that the working-classes have not received their fa r share of the benefits derived by the production and application of machinery. A correspondent in your 21st Number states, it is capital that employs human labour; it is the relative amount of capital and labour that determines the high or low rate of wages, and that this view is correct I think none will dispute. Upon the first part of I. B.'s correspondence I would offer a few remarks, he states that with the assistance of machinery a master tradesman or manufacturer is enabled to dispense with the labour of fifty of his workmen, and thereby save the amount of their wages, say £3,000 per annum, consequently he becomes a capitalist, and in most cases a landlord; and then by a curious argument I. B. attempts to show how the capitalist employs the money thus saved. A quick return is the mainspring of trade; but upon enquiry I. B. will find that the capitalists generally receive their rents half yearly, which are paid away only once during the half year, or lodged in the hands of the banker. Ah but, says I. B., the banker receives the money for the purpose of employing it in trade; granted, but the circulation of the £3,000 from the time it is taken from the working-classes, until it is again circulated amongst them, is not one twentieth part so rapid, as during the time it is in their possession. View it as we may, we find that the accumulating of money into large masses in the hands of the few, retards its circulation and injures trade. If our eyes were but piercing enough to see the rapidity with which the money passes from one to another amongst the working-classes, especially in large towns, how the shopkeepers and the poor are benefited by it, every time it is turned over, and the difference of good which the money does amongst them, to what it does in the hands of the rich, we should soon find out the cause of the distress of the poor, and say, more money ought to be conveyed from the higher classes to the lower. It very often happens that the working-classes do

not keep their money by them more than one day; it is usual for them to receive their money on a Saturday night, and lay out almost all of it the same night; they pay it to the shopkeepers and others, and turn it into a quick and rapid current, which benefits them and trade generally by the number of times that it passes from one to another; but it is soon taken up again by the tenents of houses, farmers, &c., and paid into the hands of the capitalist again, were it lays completely out of the reach of the working-classes and trade for a long time. A great deal of attention has been paid to increase the supply, but very little in proportion to get the demand for labour; many machines have been invented, so as to ensure a very large supply of goods, and many men have been employed to make these machines; now we are almost set fast for want of the demand. As the supply increases, the demand decreases, as machinery increases, it diminishes the wages of the workmen, which prevents them from giving their share of the demand. Machinery at present is only in its infancy, it is as land uncultivated, it is not yet brought into that pure use for which it is intended; it may be termed a wild and savage animal, with but one eye; and that is directed to his master; but on the other side it turns round upon the men and gets them down, and if it does not worry them, it binds them in chains so as to disqualify them from rendering any essential service to the country, to trade, or to their masters. Their masters begin to find that something is the matter, but appear not to know what it is; from time to time they complain trade is bad, but seem to be ignorant of the cause; they do not understand that they are in need of the suffering workmen, to give a sufficient demand for their manufacture. It is only a just punishment for their sins, in defrauding the poor of the benefit of their industry, to which they have an unquestionable and just right.

Let those who wish to do essential good to their country, endeavour to shorten the time which money stops in the hands of the higher classes of society. This would be striking at the very root of the evil under which the nation groans. I will conclude with the words of Mr. George Combe. The first step towards the improvement of the great mass of the people must be to reduce the hours of labour, and to dedicate a portion of time daily to the improvement of the mental faculties.

Yours Respectfully,

ANTHONY MORTON.

## BIOGRAPHICAL NOTICES.

### CARTWRIGHT.

ONE of the most striking instances of the benefit society has derived from the introduction of machinery, is the very low price at which our common articles of dress can now be purchased, compared with their price when they were all manufactured by hand. A servant maid in the present day can afford to dress herself more handsomely than persons in a far higher station in society at the commencement of the last century. Indeed, the people, by which we mean the great body of the middle and working classes, have benefited much more by the change than the higher class of society has, because the articles of dress that have been reduced so much in price, are those that are more required by the former classes than by the latter. We allude more particularly to the woollen and cotton manufactures. We gave an account, a Number or two back, of the astonishing increase that had taken place in the demand for cotton goods, and also how greatly their price had been reduced. This national blessing, for such it is, since nearly every class of society is enabled to procure comfortable decent clothing, is mainly attributable to the excellent man of whom we are about to give a short notice. His biography affords a memorable example of what may be done by perseverance; and "the Pursuit of Knowledge under Difficulties," to which we are indebted for our materials for this sketch, does not afford a brighter instance of the utility of that "little learning" that is so much dreaded by some persons and despised by others.

Edmund Cartwright was born in the year 1743, and was the fourth son of William Cartwright, Esq. of Marnham, in Nottinghamshire. One of his elder brothers was the late Major John Cartwright, so well known for his steady devotion through a long life to what he believed to be the cause of truth and patriotism, and for many public and private virtues which commanded the respect even of those who differed most widely from him in politics. Being intended for the church, Edmund at the usual age was entered on University College, Oxford, from whence he was subsequently elected a Fellow of Magdalen College. He early distinguished himself by his literary attainments, an evidence of which he gave to the world while yet a young man by the publication of a small volume of Poems, which was

very favourably received. About the year 1774, also, he became a contributor to the Monthly Review; for which he continued to write during the following ten years.

For the first forty years of his life he had never given any attention to the subject of mechanics; although, as was recollected long afterwards, his genius for invention in that department had once displayed itself, while at his father's house during one of his college vacations, in some improvements which he made on an agricultural machine which happened to attract his notice. But this exercise of his ingenuity, being out of the line of his pursuits at that time, led to no other attempt of the kind, nor to any further application of his thoughts to such matters. The circumstances which many years after this led him to the invention of his weaving machine, or power-loom, as it is commonly called, cannot be better described than they have been by himself in the following statement,—first printed in the Supplement to the Encyclopædia Britannica. "Happening," he says, "to be at Matlock in the Summer of 1784, I fell in company with some gentlemen of Manchester, when the conversation turned on Arkwright's spinning-machinery. One of the company observed that as soon as Arkwright's patent expired, so many mills would be erected, and so much cotton spun, that hands would never be found to weave it. To this observation I replied, that Arkwright must then set his wits to work to invent a weaving-mill. This brought on a conversation upon the subject, in which the Manchester gentlemen unanimously agreed that the thing was impracticable; and in defence of their opinion they adduced arguments which I was certainly incompetent to answer, or even to comprehend, being totally ignorant of the subject, having never at the time seen a person weave. I controverted, however, the impracticability of the thing by remarking that there had been lately exhibited in London an automaton figure which played at chess. Now you will not assert, gentlemen, said I, that it is more difficult to construct a machine that shall weave, than one that shall make all the variety of moves that are required in that complicated game. Some time afterwards a particular circumstance recalling this conversation to my mind, it struck me that, as in plain weaving, according to the conception I then had of the business, there could be only three movements, which were to follow each other in succession, there could be little difficulty in producing and repeating them. Full of these ideas, I immediately employed a carpenter and smith to carry them into effect. As soon as the machine was finished, I got a weaver to put in the warp, which was of such materials as sail-cloth is usually made of. To my great delight a piece of cloth, such as it was, was the produce. As I had never before turned my thoughts to mechanism, either in theory or practice, nor had seen a loom at work, nor knew anything of its construction, you will readily suppose that my first loom must have been a most rude piece of machinery. The warp was laid perpendicularly, the reed fell with a force of at least half a hundred weight, and the springs which threw the shuttle were strong enough to have thrown a Congreve rocket. In short, it required the strength of two powerful men to work the machine, at a slow rate, and only for a short time. Conceiving in my simplicity that I had accomplished all that was required, I then secured what I thought a most valuable property by a patent 4th of April, 1785. This being done, I then condescended to see how other people wove; and you will guess my astonishment when I compared their easy modes of operation with mine. Availing myself, however, of what I then saw, I made a loom in its general principles nearly as they are now made. But it was not till the year 1787 that I completed my invention, when I took out my last weaving patent, August the 1st of that year."

Dr. Cartwright's children still remember often seeing their father about this time walking to and fro apparently in deep meditation, and occasionally throwing his arms from side to side; on which they used to be told that he was thinking of weaving and throwing the shuttle. From the moment indeed when his attention was first turned to the invention of the power-loom, mechanical contrivance became the grand occupying subject of his thoughts. With that sanguineness of disposition which seems to be almost a necessary part of the character of an inventor, he looked upon difficulties, when he met with them in any of his attempts, as only affording his genius an occasion for a more distinguished triumph; nor did he allow even repeated failures for a moment to dishearten him. Some time after he had brought his first loom to perfection, a manufacturer, who had called upon him to see it at work, after expressing his admiration of the ingenuity displayed in it, remarked that, wonderful as was Mr. Cartwright's mechanical skill, there was one thing that would effectually baffle him, namely, the weaving of patterns in

checks, or, in other words, the combining, in the same web, of a pattern, or fancy figure, with the crossing colours which constitute the check. Mr. Cartwright made no reply to this observation at the time; but some weeks after, on receiving a second visit from the same person, he had the pleasure of showing him a piece of muslin, of the description mentioned, beautifully executed by machinery. The man is said to have been so much astonished that he roundly declared his conviction that some agency more than human must have been called in to assist on the occasion.

After this Dr. Cartwright exercised his ingenuity in a variety of other contrivances; and introduced valuable improvements in the combing of wool by machinery, in rope-making, and in several other departments of agriculture and manufactures. For some of these inventions he took out patents, and for others premiums were bestowed upon him by the Society for the encouragement of Arts, and the Board of Agriculture. Even the steam-engine engaged his attention; and an account of some improvements which he proposed in its mechanism may be found in Rees's Cyclopædia. Indeed, so long as forty years ago, while residing at Eltham in Lincolnshire, he used frequently to tell his son that, if he lived to be a man, he would see both ships and land-carriages impelled by steam. It is also certain that at that early period he had constructed a model of a steam-engine attached to a barge, which he explained about the year 1793, in the presence of his family, to Robert Fulton, than a student of painting under his countryman West, and whose zeal and activity afterwards, as is well-known, brought the project of steam-navigation to such perfection in America, from whence it has extended all over the civilized world. Even so late as the year 1822, Dr. Cartwright, notwithstanding his very advanced age, and although his attention was much occupied by other philosophical speculations, was actively engaged in endeavouring to contrive a plan of propelling land-carriages by steam. His death, however, at Hastings, in October 1823, prevented the completion of this, as well as of many other designs in the prosecution of which he had been employed. His enthusiasm for mechanical invention continued unabated to the last; and indeed his general energy both of mind and body was very little impaired up to within a short period of his death.

## MANUFACTURES.

### NEEDLE MAKING.

NO. II.

*Heading and Picking*,—consists in placing all the heads one way, and all the points another—a manipulation performed by children with a degree of expertness only attainable by much practice—and likewise in picking out from the whole heap the broken eyes and broken points, which, as may well be supposed, are very numerous in consequence of the severe operation last described; the former, of course, are thrown aside as wasteless, the latter are generally repointed as blunts, and made up by themselves for sale.

The ingenious and profoundly scientific Mr. Babbage describes the last-mentioned operation with great distinctness, as exhibiting, in his opinion, one of the simplest contrivances that can with propriety be called a tool. The needles are placed sideways in a heap, on a table in front of the operator. From five to ten are rolled towards this person by the fore-finger of the left hand: this separates them a very small space from each other, and each in its turn is pushed lengthways to the right or to the left, according as its eye is on the right or the left hand. This is the usual process, and in it every needle passes individually under the finger of the operator. A small alteration expedites the process considerably: the child puts on the fore-finger of its right-hand a small cloth cap or finger-stall, and rolling from the heap from six to twelve needles, it keeps them down by the fore-finger of the left-hand; whilst it presses the fore-finger of the right-hand gently against the ends of the needles: those which have their points towards the right-hand stick into the finger-stall; and the child, removing the finger of the left-hand, allows the needles sticking into the cloth to be slightly raised, and then pushes them towards the left side. Those needles which had their eyes on the right-hand do not stick into the finger-cover, and are pushed to the heap, on the right side, previous to the repetition of the process. By means of this simple contrivance, each movement of the finger from one side to the other carries five or six needles to their proper heap; whereas, in the former method, frequently only one was moved, and rarely more than two or three were transported at one movement to their place.

As there are diversities of manufacture, every user of very fine needles must of late years have heard of gold-eyed, and silver-eyed, and drilled-eyed needles, each sort

equally "warranted not to cut the thread." It may be sufficient here to say, that the well-known appearance of the former is produced by dipping the head of the needle into the spirit of ether, containing a little gold in solution, and which immediately attaches itself to the steel, when dipped in the menstruum. Needles are sometimes treated with this ethereal solution of gold all over, in order to give them a beautiful yellow colour, and at the same time to prevent them from rusting. As to the second sort, not a particle of silver, or of any thing like it, is used, the peculiar white polish of the eye being communicated by means of its application to a little cylinder stuck full of steel pegs, like the small tune-barrel seen inside those musical boxes which are so common now-a-days. The drilled-eyes constitute a real improvement: not, indeed, that the eye itself is actually formed by drilling, any more than the silver-eyed needles owe any portion of their finish to that metal; but the eyes being countersunk, and smoothed on both sides by a drill after punching, they not only look well, but are when carefully made, little, if at all, liable to cut the thread. They, likewise, rarely break in the eye,—the common fault of common needles,—because they are not only made of the very best material, but being moreover blued or softened, to allow the drill to cut, they are not so brittle as otherwise they would be.

*Blue Pointing*,—or the communicating of that exquisite polish which all the best needles are seen to possess,—is performed by applying them, several together, to a revolving stone about the size and shape of one's finger: this stone is of a slaty-blue colour, and comes from Warwickshire. This is generally the finishing operation; after which the needles are made up in little packages of a quarter of a hundred, labelled, and wrapped up in larger parcels for sale. The cheapness of the commoner sort of needles has frequently been the theme of wonder, with those persons who have considered the variety of manipulations through which they must have passed on the other hand, needles of the most exquisite delicacy and finish exhibit one of the rarest proofs of the value conferred by manual labour upon a material in its original state of small nominal price; for some of the finest sorts are worth considerably more than their weight in gold.

## PERPETUAL MOTION.

*To the Editor of the Penny Mechanic.*

SIR.—The answer of your Correspondent J. W. Ritchie to my letter, inserted in the last Number but one of your Magazine, proving the fallacy of his plan of obtaining perpetual motion by means of springs, is still more absurd than before, he says now, the springs are not to be of equal power, but one of them must be stronger than the other. I can well understand that the stronger spring can set in motion the weaker one, but cannot for the life of me make out, how the weaker one can overcome the stronger! And I dont know what he means by saying that the "fly-wheel goes very far." I would with the greatest pleasure, make a model, and try the experiment myself, but I am not over-fond of throwing away time, trouble, and expense, upon a thing which when completed, I am confident would not succeed.

As to J. W. Ritchie's having made one himself, and proved it with success, I am very sure that is not the case, he might have made one certainly, but I am confident it did not succeed; and any person possessing the least grain of sense, must at once see the absurdity as well as the impossibility of such a proposition, it being decidedly against the *laws of Mechanics*.

You would do us both a very great favour, Mr. Editor, if you would have the goodness to state, at the end of this communication, whether J. W. Ritchie, is right or

Your most Obedient Servant.
BRACK'S BROTHER.

*** In Number 8, we have stated at length our opinion respecting the possibility of obtaining a perpetual motion. We do not suppose Mr. Ritchie thinks he can produce any thing of the kind, though the title of his communication might certainly bear that interpretation. With respect to his engine, it is evident that if both the springs are of equal power, the fly-wheel can only continue in motion for a short time, and then it will be stopped by friction; it will gain nothing from either of the springs. And if one of the springs is formed stronger than the other, the stronger will certainly prevent the other having any motion whatever. In either case the machinery would only continue in motion while the impulse that first set the fly-wheel in action remained.—ED. P.M.

### RAILWAYS.

The number of proposed railways, including diversions, extensions, and branches, in England and Wales, for which plans have been lodged in the Private Bill Office in the present session, is seventy-five, of which only forty-eight are under the consideration of Parliament; these amount in length to twelve hundred and thirty-three miles, and are estimated at the sum of nineteen millions three hundred and fifty-two thousands seven hundred and twenty-six pounds, or fifteen thousand six hundred and ninety-five pounds per mile. The whole length of tunnelling is twenty-five miles; and the number of bridges, exclusive of viaducts and culverts, two thousand eight hundred and twenty-five, or nearly two and a third per mile. The weight of iron required for the rails, is one hundred and ninety-three thousand five hundred tons; and of stone for the blocks, two millions six hundred and seventy thousand tons. The area of land required to be taken is upwards of fifteen thousand acres; and of felt for the chairs, one hundred and thirty acres. These railways, if carried into execution, would employ at least five thousand men and fifteen hundred horses for three years, for the earthworks alone.—*Whishaw.*

## INSTITUTIONS.

### LECTURES DURING THE WEEK.

*London Institution*, Finsbury Circus.—Monday, April 17, at 1 o'clock, afternoon, R. Bond, esq., on Physical Geography.—Thursday, April 20, at seven, H. J. Gauntlett, esq., on Ecclesiastical Music.

*London Mechanics' Institution*, Southampton-buildings, Chancery-lane.—Wednesday, April 19, at half-past eight, Mr. Cull, on Phrenology.—Friday, 21, Dr. Ritchie, on Optics, &c.

*Western Literary and Scientific Institution*, 47, Leicester-square.—Thursday, April 20, at eight, C. Buckingham, esq., M.P., on Palestine.

*Eastern Athenæum*, Stepney Square.—Wednesday, April 19, at eight, Col. Thompson, M.P., on Free Trade.

*Southwark Literary Society.*—Wednesday, April 19, W. Lucking, esq., on Fossil Organic Remains, at eight.

*Lambeth Literary and Scientific Institution.*—Tuesday, April 18, at half-past eight, F. J. Searle, esq., on the Construction of the Drama.

*Poplar Institution*, East India Road.—Tuesday, April 18, at eight, R. Addams, esq., on Caloric, Illustrated with Chemical Apparatus, and Pleasing Experiments.

*Tower Street.*—Monday, April 17, at eight, Mr. Coupland, on the Mathematics.

*Bermondsey Mutual Instruction Society.*—Monday, April 17, at quarter past eight, Mr. Showler, on the Circulation of the Blood.

*Finsbury Mutual Instruction Society.*—Tuesday, April 18, at half past eight, Mr. Logan, on Phrenology.

### QUERIES.

*Lucifer Matches.*—I have been endeavouring to make "Lucifer Matches," but have not succeeded: perhaps you can give me a recipe in your next Number?

Yours, &c.

No. Chemist.

[The composition of which they are formed is the same as that used to make "Waterloo Crackers:" it is an exceedingly dangerous chemical compound, and we should therefore advise our correspondent not to attempt to make the Lucifers himself, but procure them at some of the shops. "No Chemist" should become one. We recommend him to read, and practise the experiments described in "Parke's Chemical Catechism," or "Griffins' Chemical Recreations."

Lucifers are made as follows. Equal quantities of chlorate of potash and sulphuret of antimony are to be made of a semifluid consistency with a little gum water. Matches pointed with brimstone are then to be dipped into it, and when the matches dry they will ignite on being drawn briskly through sand paper.—Ed. P. M.]

*Rubbers of Electrifying Machine.*—Could you inform me through the medium of your valuable Magazine, what it is that is put upon the rubber of an Electrifying Machine.

[An Amalgam formed of three parts of Mercury, two of Zinc, and one of Tin.—Ed. P. M.]

*Spots on Polished Steel.*—Will some of your readers have the kindness to inform me how I can remove Spots from Polished Steel, without injuring the polish. F.

### TO CORRESPONDENTS.

"A. L. O. R." It was stated by mistake in our last Number, that the Lunar Eclipse would take place on the 30th instant. It should have been "the 20th instant."

"J. C." We have very lately given an article on the subject.

"An Amateur Mechanic," "C. D. T." and "E. W." will see what we have said respecting the subject of their communications.

Will "Mr. Gregory" favour us with another description of his Rotary Pump?

We have received "Mr. Cowell's" Sash Suspenders and Letter. The subject shall receive our early attention.

We are obliged to "C. D. T." for the answer.

"C. G.'s" Query, shall have a reply.

Notice.—Some of our Correspondents have complained that their letters have not been answered. This is in consequence of their not having been directed properly. All communications should be addressed, "To the Editor of the Penny Mechanic, at Mr. Berger's, Holywell Street, Strand.

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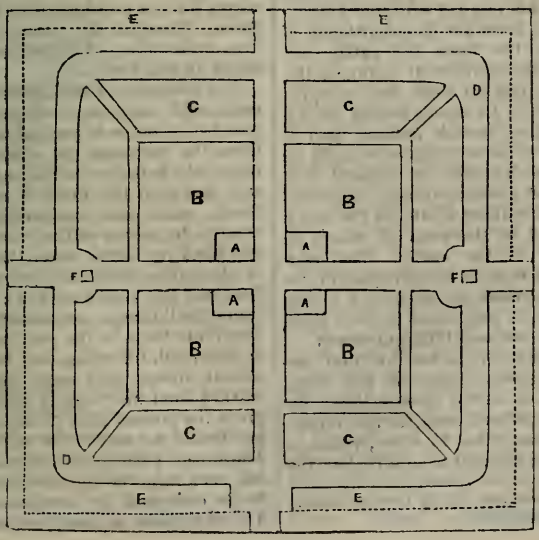
# THE PENNY MECHANIC.

A MAGAZINE OF ARTS AND SCIENCES.

No. XXVI.] SATURDAY, APRIL 22, 1837. Vol. I.

ISLINGTON LIVE CATTLE MARKET.

GROUND PLAN.






Holloway Press: D. A. Doudney

## ISLINGTON LIVE CATTLE-MARKET.

The question of the removal of Smithfield Market being again brought before the legislature, we have thought a sketch of the plan and dimensions of the lately-constructed, and now legalized market at Islington, may interest our readers. As, however, the comparative eligibility of the two markets for the sale of live cattle has elicited a considerable degree of party controversy, we beg distinctly to disclaim any participation in such feelings. Every discovery or improvement tending to enlighten the mind, improve the condition of man, or promote the practice and knowledge of humanity among all the classes of mankind, we deem fit subjects for our pages; we shall now state the facts connected with both markets. The site of Smithfield Market was in the reign of Henry I., a field with several ponds in it. Fairs and markets, however, had been held on the spot from the time of Alfred, about 886. Henry I. gave this field to a favourite of his, named Rahere.† He levelled it, and filled up the ponds, after which it was called Smoothfield. Justs and tournaments were held here down to the time of Edward IV. The present legalized area for the sale of cattle is under four acres and a half, and will contain about 1,500 bullocks, and 15,000 sheep, leaving no room for calves or pigs. Space, however, is required for 3,500, and at times for 5,000 head of cattle, and 35,000 sheep. The manner the business of the market is now conducted is by keeping the surplus cattle in the adjacent streets, till those in the market are sold and removed to make room for the admittance of others. From the time the cattle are brought into the market at night, to the closing of the market next day, comprehends a period of 18 hours, during which space of time they remain without food or water to allay a burning thirst brought on more speedily by over excitement and fatigue. As our business is only connected with facts, we will not dilate on the many evils generated by the want of space, or the treatment of the cattle. We refer those who may wish to see this part of the subject treated more at large, to a cheap pamphlet recently published by W. Clark, corner of Newgate and Giltspur-street.

The engraving represents the chief entrance, and ground plan of the New Market, situated in the Lower Road, Islington; the enclosed area for the reception of cattle comprises 15 acres, which is laid out in the form of a square, but the whole site, comprehending offices for clerks and other buildings consists of 21 acres. In the centre are four erections A, A, A, A, which have been constructed for the accommodation of eight bankers, or money-takers. The centre, which is intended to be occupied as an Exchange for the meeting of salesmen and graziers is quadrated by roads crossing it at right angles, and lying opposite to the entrance gateways. Drains and sewers run through the whole area. From the centre four spaces are portioned off for sheep, B, B, B, B, these are subdivided into 1,300 compartments or pens, capable of containing from 30,000 to 35,000 sheep, leaving ways in every direction for their ingress and egress: adjoining to the sheep-pens are other spaces for cattle, C, C, C, C, called layers, where the beasts may range. Here they may be foddered and watered from market-day to market-day, or until the purchasers find it convenient to remove them. Round these capacious layers is a wide road, D, D, D, D, connecting the other open ways for the sheep and cattle, offering excellent facilities for their free passage in and out of the market. On the other side of this general road are covered sheds, over other spacious layers E, E, E, E, exteriorly supported by a substantial brick wall about ten feet high, the four sides of which are each 800 feet long. The roofing of the sheds in span is 25 feet, and is supported interiorly on columns. These sheds are divided into stalls, where cattle may be exhibited for sale protected from the weather, with alleys for the purchasers to pass between them. Troughs for water are supplied from tanks F, F. The layers will contain about 10,000 bullocks.

The situation of this market is the best that could have been selected for its purpose; it lies open to most of the great roads from the northern and eastern counties, from which the principal supply of cattle and sheep to the London market is derived, and also communicates conveniently, by means of the New North Road and the City Road, with the greater part of the town, without goading the cattle first into the centre of the city, and then through all the narrow streets, in order to distribute them to the purchasers. It may be observed, likewise, that the New Road affords direct and easy access to the market from the western roads. We have given the ground plan of the quadrangular portion of the market for cattle and sheep. The lower part is of irregular form, and has been reserved for slaughter-houses, or to be occupied by enclosures for pigs. The objections against Smithfield Market

† There is a street now leading from St. John's-street, name Rahere-street.

are want of room, and the consequent punishment or cruelty inflicted on cattle and the inconveniences it entails on the persons who reside in its neighbourhood. The deterioration of property it occasions on the whole of the north side of London. The rendering the meat unwholesome by the cattle being too much excited and bruised immediately before their being killed; also its demoralizing effects on the lower classes from the brutality it occasions. To which may be added, the loss to the graziers and the public by the depreciation of the quality of the meat. The cruelty, however, inflicted on the cattle, is a question which should rouse the apathy of all persons who possess feelings of humanity. All animals taken from Smithfield Market and immediately slaughtered, are more or less in a feverish state; their heads, necks, hocks, and backs are most frequently loaded with extravasated blood, occasioned by the discipline they undergo in the hands of the drovers. Every market-day a certain number of beasts and sheep are so mutilated, exhausted or bruised in the market, as to render it necessary to have them forthwith slaughtered, the meat afterwards being sent to the dead market for sale. If the Islington Market were substituted for that of Smithfield, the cattle immediately on their arrival from the country would be accommodated with places of rest on the same spot where they would be offered for sale, having fodder and water for their refreshment the whole time.

The use of this market would also preclude the necessity of immediately driving the cattle purchased through the streets in droves, as they might remain on the spot until wanted. In Smithfield Market large numbers every market-day, which have not been sold, have to be driven back through the streets, and of course again to be brought to market until disposed of to a butcher. At Islington Market the unsold cattle or sheep, would remain in their layers undisturbed, and would not be repeatedly brought out to crowd the streets of London, and annoy the public. These are the main points of consideration for and against the two markets.

## THE HUMAN BODY.

### DIGESTION.—NO. I.

We have in former papers pointed out some of the more remarkable phenomena connected with the blood; we have described its composition, and the important purposes to which it is applied; it is proper that we should now explain the manner in which the blood itself is formed. The first process by which this is effected is termed Digestion.

There is no study can equal the study of ourselves: indeed, in acquiring a knowledge of the anatomy and physiology of the human body, we acquire a knowledge of nearly every other science. In the bones we see beautifully exemplified the strength of materials, and the most advantageous manner in which the mechanism of our frames can be employed; thus we learn something of mechanics. If we examine the organs of the senses, we at once perceive their adaptation to the laws of optics, acoustics, and heat, or the adaptation of those laws to *them*. Again, we inquire into the physiology of respiration, and we at once learn the constitution of the atmosphere; the nature of the gases which compose it, and the effect meteorological changes have upon our health. If we turn our attention to the subject of this paper, if we endeavour to learn something of the wonderful process of digestion, we at the same time enter into an investigation of some of the more interesting phenomena of chemistry. Thus, within ourselves, we have the means of learning many of the most striking facts in every branch of science. What more need we urge in favour of such a study. "The proper study for mankind is man." We use the word in its physical sense. We know the study is not popular, but it will be so; and we will do what we can to make it so. Persons at present have not the slightest knowledge on the subject, or they would desire to know more; and we are well assured that all men naturally have so deep an interest in the subject, that the time will arrive when a mother who from ignorance does not know how to preserve the health of her infant or herself; or when a man does not know how to avoid infringing the organic laws to which his physical constitution is liable, will be considered *very* ignorant, and very bad members of society. Let it not be supposed that in order to obtain this knowledge, a man or woman must necessarily study all the different sciences we have mentioned. On the contrary a very little knowledge of them is amply sufficient; and this will be acquired in making ourselves acquainted with the body itself. We shall see the truth of this in the present and following papers.

Digestion is the name given to the process by which the food we eat is converted into a fluid, which, after being exposed to the action of the air in the lungs, becomes blood. When we consider how various

are the substances and liquids taken into the stomach, we may well be surprised that any power or process, can convert them into a fluid so entirely dissimilar as the blood; yet such is the case. And this is effected by a chemical change in the food in the stomach.

The first operation in every chemical process is to divide the portion of substance to be acted upon very minutely, in order that the chemical agent may act as much upon the particles of the mass as possible; because all chemical changes are those which take place among the *particles* of matter; and in this chemistry is distinguished from mechànics, which relates only to the changes among *masses*. Previous to the food being introduced into the stomach, it is accordingly subdivided by the teeth. Another operation also takes place in the mouth. If we wished to dissolve a lump of chalk easily, and mix it equally in a quantity of water, we should not only divide it into minute portions, but we should make it into a semi-fluid mass, by mixing it with some liquid. If we did this it could easily be dissolved in a large quantity of water. Now a process very similar to this takes place during mastication. The food is not only minutely divided in the mouth, but it is also made into a pulpy mass by being mixed with the saliva. Thus it is prepared for a chemical change in the stomach, in the best possible manner that can be adopted.

Before describing the change that takes place in the stomach, we will see how the effect we have been describing is produced. First of the instruments by which it is accomplished—the teeth. In infancy, the child feeding on the softest food, has no occasion for, and is not provided with teeth; but as we advance in years, and require a different kind of food, the teeth are then formed. They are the hardest and whitest of the bones. The part above the gums is called the body of the tooth; that below, the fangs, or root; the boundary between them, just below the edge of the gum, is called the neck, where there is usually a slight depression. The body of the tooth is covered with enamel, and the fangs with a membrane commonly covering the bones, called the *periosteum*, which likewise lines the socket in which the tooth is placed. Each tooth has a cavity that is supplied with blood-vessels and nerves, through a hole in the root. The teeth are fixed into a bony substance called the Abveolar process, and they are kept in their places by the gums, which are exceedingly vascular, though possessed of little sensibility. The gums of infants have a hard ridge extending through their whole length, but this is not found in aged persons who have lost their teeth. At full maturity the number of teeth is usually thirty-two; sixteen above, and the same number below, the number, however, occasionally varies in different persons. The teeth are divided into three classes; the incisors; the canini; and the molares or grinders. The incisors are the four teeth in front of each jaw; in the upper jaw they are usually broader and thicker than those in the lower, over which they fall, by being placed a little obliquely—they are called incisors from their office being to divide and cut the food. The canine, or cuspidati, are the longest of all the teeth, and derive their name from their resemblance to a dog's tusk. There are a distinguishing characteristic of animals that feed on flesh. There are two in each jaw, one on either side of the incisors or cutting teeth. Mr. Hunter says, "a similarity in shape, situation, and use, may be traced from the most imperfect carnivorous animal, man, to the lion, which is the most perfectly carnivorous;" but in man the canine teeth, as also the incisors and molares, are shaped differently, not being so long as in some beasts, nor curved as in others. The molares or grinders are ten in number in each jaw. The incisors and canine have but one fang, but the three last grinders in the under jaw have two fangs, and those in the upper three fangs. The two grinders in each jaw next the canine are called bicuspides. The enamel of the teeth is the hardest production of the human body; it strikes fire with steel, and it resists decay when the centre of the tooth has fallen into dust. When the enamel is broken off the tooth, and its body exposed, the tooth quickly decays. The component parts of enamel are nearly the same as those of bone. Phosphate of lime is deposited, with a portion of animal gluten, and a small proportion of the carbonate of lime enters into its composition, the same as it does in bone. It is the union of the glutinous matter which bestows the extreme hardness, for when the tooth is within the jaw, and in an early stage of its formation, the deposition is soft, and its surface rough, but by a change in the surface which throws out the earthy deposit, the first deposition is penetrated with gelatinous secretion which bestows the density and extreme hardness of this crust. Enamel is peculiar to the teeth, and is only found upon the body of the teeth; when broken it appears fibrous or striated, and all the striæ are directed from the cir

cumference to the centre; it is thickest on the grinding surfaces, and on the cutting edges or points of the teeth, becoming gradually thinner as it approaches the neck, where it terminates insensibly. The enamal affords no appearance of vacularity, or of having any circulation of blood within it; it receives no tinge from madder when given to an animal during life, and no injection has yet been able to show that it possesses blood-vessels or absorbents.

## INDIAN METHODS OF WORKING IRON AND STEEL.

*On the Damascus Gun Barrels.*—The gun-barrels made at Bombay, in imitation of Damascus, so much valued by the Orientals for the beauty of their twist, are manufactured of iron hoops, obtained from European casks, mostly British. The more these hoops are corroded with rust, they are proportionably acceptable to the workman: should there be any deficiency of this necessary oxydation, they are regularly exposed to moisture, until they are sufficiently prepared for welding. Being cut into lengths of about twelve inches, they are formed into a pile, an inch or an inch and a half high, laying the edges straight, so as not to overlap each other: a longer piece is then so fitted as to return over each end, and hold the whole together in the fire. This pile is then heated to a welding heat, and drawn out into a bar of about one inch wide, and one third of an inch thick; it is then doubled up in three or more lengths, and again welded and drawn out as before; and this operation is repeated generally to the third or fourth time, according to the degree of fineness of twist required. The bar is then to be heated about a third of its length at a time, and being struck on the edge, is flattened the contrary way to that of the stratification. This part of the operation, brings the *wire* or *vein* outwards upon the strap. The barrel is then forged in the usual way, but much more jumping, or upsetting endways, by striking the barrel against the side of the anvil while it is of a welding heat, than in the English method, in order to render the twist finer. The most careful workmen always make a practice of covering the part exposed to the fire with a lute, composed of mud, clay, and the dung of cows or horses, in order to guard against any unnecessary oxydation of the metal. When the barrel is completed, the twist is raised by laying the barrel, from one to five days, either in vinegar, or a solution of the sulphate of iron, until the twist is raised; this process is called the *wire twist.*

To produce the *curl*, the bars or straps are drawn into bars about three quarters of an inch square, and twisted, some to the right and others to the left hand; one of each sort is then welded together, doubled up and drawn out, as before described; and according to the skill and experience of the workman, any intricacy of twist is produced, by thus drawing out, doubling and twisting.

Sometimes, to save trouble, and economise the iron thus prepared, the artist will rough file an English barrel, weld a strap of Damascus iron spirally round it, or several straps are laid longitudinally along it, and welded on. A native artist never works with pit coal, under any consideration: charcoal from light wood forms his only fuel.

*On the Damascus Sword Blades.*—In making the sword blades, there are several methods used; some workmen make a pile of alternate layers of softer and harder cast-steel, with powdered cast-iron mixed with borax, sprinkled between each layer. These are drawn out to one-third more than the length of the intended blade, doubled up, heated, twisted and re-forged several times; *the twist is brought out* in the same way as that in the gun-barrels, namely, by the use of vinegar, or a solution of sulphate of iron.

Some sword-blades are forged out of *broad* plates of steel thus prepared, with a narrow plate of good iron welded between them, toward the back, and thus leaving *solid steel for the edge*, to a considerable depth. Others prefer to make them of one plate of steel, with a lamina of iron on each side of it, to give them strength and toughness. Swords of this description were tempered in my brother's presence, in the following compound; and, as he states, with considerable effect.

*The Hardening Composition.*—The blade was covered with a paste, formed of equal parts of barilla, powdered egg-shells, borax, common salt, and crude soda, heated to a moderate read heat; and just as the red was changing to a black heat, quenched in spring-water.

From the information of the workman, it appears that Damascus obtains all its steel from the upper part of the Deccan, where it is called *jonlode h nd*, or Indian steel, of which there are great quantities, and but little or no demand for it. The *Damasaque* (or *joar*) is natural to this steel; and the veins in it are raised by immersing the blades in acid solutions.—*Young Mechanic.*

# MANUFACTURES.

## PAINTING ON GLASS.

At the time when vast sums of money were expended by pious individuals in endowing churches, and chapels, and in repairing and building cathedrals, the art of glass painting attained a very high state of perfection. From this state however it soon declined when the patronage it had been used to receive was no longer extended to it, until at last it was so much neglected that it was supposed to be a lost art. This however, it appears is not the case. A knowledge of the means by which the artists of the middle centuries were enabled to produce such beautiful specimens of stained glass still remains. A correspondent in a late number of the Philosophical Magazine communicates the following interesting particulars.

It is a singular fact, that the art of glass-painting, practised with such success during former ages from one end of Europe to the other, should gradually have fallen into such disuse, that in the beginning of the last century it came to be generally considered as a lost art. In the course of the eighteenth century, however, the art again began to attract attention, and many attempts were made to revive it. It was soon found by modern artists, that by employing the processes always in use among enamel painters, the works of the old painters on glass might in most respects be successfully imitated; but they were totally unable to produce any imitation whatever of that glowing red which shed such incomparable brilliancy over the ancient windows that still adorn so many of our churches. For this splendid colour they possessed no substitute, until a property, peculiar to silver alone among all the metals, was discovered, which will presently be described. The art of enamelling on glass differs little from the well-known art of enamelling on other substances. The colouring materials (which are exclusively metallic) are prepared by being ground up with a *flux*, that is, a very fusible glass, composed of silex, flint-glass, lead, and borax: the colour with its flux is then mixed with volatile oil, and laid on with the brush. The pane of glass thus enamelled is then exposed to a dull red heat, just sufficient to soften and unite together the particles of the flux, by which means the colour is perfectly fixed on the glass. Treated in this way, gold yields a purple, gold and silver mixed a rose colour, iron a brick-red, cobolt a blue; mixtures of iron, copper and manganese, brown and black. Copper, which yields the green in common enamel-painting, is not found to produce fine colour when applied in the same way to glass, and viewed by transmitted light; for a green therefore recourse is often had to glass coloured blue on one side and red on the other. To obtain a yellow, silver is employed, which either in the metallic or in any other form, possesses the singular property of imparting a transparent stain, when exposed to a low red heat in contact with glass. This stain is either yellow, orange, or red, according to circumstances. For this purpose a flux is used: the prepared silver is merely ground up with ochre or clay, and applied in a thick layer upon the glass. When removed from the furnace the silver is found not at all adhering to the glass; it is easily scraped off, leaving a transparent stain, which penetrates to a certain depth. If a large proportion of ochre has been employed, the stain is yellow; if a small proportion, it is orange-coloured; and by repeated exposure to the fire, without any additional colouring matter, the orange may be converted into red. This conversion of orange into red is, I believe, a matter of much nicety, in which experience only can ensure success. Till within a few years this was the only bright red in use among modern glass-painters; and though the best specimens certainly produce a fine effect, yet it will seldom bear comparison with the red employed in such profusion by the old artists.

Besides the enamels and stains above described, artists, whenever the subject will allow of it, make use of panes coloured throughout their substance in the glass-house melting-pot, because the perfect transparency of such glass gives brilliancy of effect, which enamel-colouring, always more or less opake, cannot equal. It was to a glass of this kind that the old glass-painters owed their splendid red. This in fact is the only point in which the moderu and ancient processes differ, and this is the only part of the art which was ever really lost. Instead of blowing plates of solid red, the old glass-makers used to *flash* a thin layer of red over a substratum of plain glass. Their process must have been to melt side by side in the glass-house a pot of plain and a pot of red glass: then the workman, by dipping his rod first into the plain and then into the red glass pot, obtained a lump of plain glass covered with a coating of red, which by dexterous management in blowing and whirling, he extended into a plate, exhibiting on its surface a very thin stratum of the

desired colour. That such was the method in use, an attentive examination of old specimens affords sufficient evidence. One piece in the possession of the Editor of the Philosophical Magazine exhibits large bubbles in the midst of the red stratum; another consists of a stratum of red inclosed between two colourless strata: both circumstances plainly point out the only means by which such an arrangement could be produced. In this state the glass came into the hands of the glass-painter, and answered most of his purposes, except when the subject required the representation of white or other colours on a red ground: in this case it became necessary to employ a machine like a lapidary's wheel, partially to grind away the coloured surface till the white substratum appeared.

The material employed by the old glass-makers to tinge their glass red was the protoxide of copper, but on the discontinuance of the art of glass-painting the dependent manufacture of red glass of course ceased, and all knowledge of the art became so entirely extinct, that the notion generally prevailed that the colour in question was derived from gold. In 1793 the French government actually collected a quantity of old red glass, with the view of extracting the gold by which it was supposed to be coloured! Le Vieil was himself a glass-painter employed in the repair of ancient windows, and the descendant of glass-painters, yet so little was he aware of the true nature of the glass, that he even fancied he could detect the marks of the brush with which he imagined the red stratum had been laid on! It is not a little remarkable that the knowledge of the copper-red should have been so entirely lost, though printed receipts have always existed detailing the whole process. Battista Porta (born about 1540) gives a receipt in his *Magia Naturalis*, noticing at the same time the difficulty of success. Several receipts are found in the compilations of Neri, Merret and Kunckel, from whence they have been copied into our Encyclopædias. None of these receipts however state to what purposes the red glass was applied, nor do they make any mention of the *flashing*. The difficulty of the art consists in the proneness of the copper to pass from the state of protoxide into that of peroxide, in which latter state it tinges glass green. In order to preserve it in the state of protoxide, these receipts prescribe various doxygenating substances to be stirred into the melted glass, such as smiths' clinkers, tartar, soot, rotten wood and cinnabar.

One curious circumstance deserves to be noticed, which is, that glass containing copper when removed from the melting-pot sometimes only exhibits a faint greenish tinge, yet in this state nothing more than simple exposure to a gentle heat is requisite to throw out a brilliant red. This change of colour is very remarkable, as it is obvious that no change of oxygenation can possibly take place during the *recuisson*.

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## COWELL'S SASH SUSPENDERS.

*To the Editor of the* PENNY MECHANIC.

SIR,—I observe in your Magazine of March 18, a plan for detaching sashes from their lines,—as reference is made to my plan, and an idea raised, that in consequence of its being a patented article, the expense will prove an obstacle,—I forward the accompanying circular, &c., hoping it will fully explain and satisfy you that your correspondent is unnecessarily alarmed, if expense is the only consideration that prompts the introduction of his plan.

I likewise forward one of my suspenders, each iron and brass, that you may see at once the principle I have adopted —the iron I enable the trade, viz. ironmongers, to sell at 4½*d.* each, the brass at 7½*d.* each. So that per sash as named by your correspondent, the cost would be, if fitted with iron suspenders, 9*d.*, if with brass, 1*s.* 3 '.; but a pair of sashes, including the bead bolt and side plates, which are indispensable, the sum named in my circular is from 2*s.* 6*d.* to 5*s.*. Its merits compared with Mr. Clement's suggestion I leave to your decision, and am most respectfully

Your Obedient Servant.

H. B. COWELL.

*** We are sincerely glad to find that for so trifling a sum so many of the accidents from window-cleaning we have before spoken of can be prevented. "Cowell's Sash Suspender" ought to be used for the windows of every house that is hereafter built; and as every one can now have their windows made so much more convenient for cleaning, at so little expense, we hope the invention will come into general use. It is exceedingly simple in its construction, and exceedingly ingenious. Mr. Cowell deserves well of society for having made public a plan by which so many lives may be preserved that are now being constantly placed in jeopardy.—ED. P. M.

## MISCELLANIES.

*The Best Method of Preparing Glue.*—In the purchase of glue, it would be well to select it in warm, damp weather, for then if the oily substance has not been thoroughly separated in its manufacture, it will be soft like India rubber. This will neither dry nor hold well, and after being melted, will in a short time turn black and taint. The method I have adopted for improving glue, is to add a gill of vinegar, alcohol, or cider, when dissolving it in a common glue pot, and afterwards, as much water as necessary. Glue prepared in this way, will melt much quicker and hold the heat longer, than in the common method, and when used on wood, will dry much better and will not taint. The vinegar I think is best, as it does not evaporate so rapidly as alcohol.

*A Large Tree.*—An oak tree was a short time ago felled in Ludlow, near Shropshire, the produce of which was thirty-nine tons of timber, fifty-five cords of wood, two hundred park pales, and four cords of brackets. A bough broke off before the tree was cut down which weighed seven tons and a half. Three men were employed a month in stacking it. The tree was valued at £165.

## INSTITUTIONS.

### LECTURES DURING THE WEEK.

*London Institution.* Finsbury Circus.—Monday, April 24, and Thursday, 27th, at 7 o'clock, G. James, esq., on the Sacred Poetry of Great Britain.

*London Mechanics' Institution,* Southampton-buildings, Chancery-lane.—Wednesday, April 26, at half-past eight, Mr. Cull, on Phrenology. —Friday, 28, Dr. Ritchie, on Optics, &c.

*Western Literary and Scientific Institution,* 47, Leicester-square.—Thursday, April 27, at eight, C. Buckingham, esq., M. P., on Palestine.

*Lambeth Literary and Scientific Institution.*—Tuesday, April 25, at half-past eight, W. T. J. Morton, esq., on the Constitution of the Atmosphere.

*Southwark Literary Society.*—Wednesday, April 26, F. Statham, esq., on Optics, at eight.

*Poplar Institution,* East India Road.—Tuesday, April 25, at eight, H. Brown, esq., on the Nature and Tendency of Works of Fiction.

*Mutual Instruction Society,* 16 Great Tower-street. —Monday, April 24, at eight, Mr. Shearman on the Emancipation of the Jews.

*Bermondsey Mutual Instruction Society.*—Monday, April 24, at quarter past eight, Mr. Showler, on the Circulation of the Blood.

*Finsbury Mutual Instruction Society.*—Tuesday, April 25, at half past eight, Mr. J. Smith, on the Acquisition of Knowledge.

## QUERIES.

*To the Editor of the Penny Mechanic.*

SIR,—Having observed a query in your valuable periodical No. 24, "why, if the rays of the Sun are suffered to fall on the fire, they will put it out," I should advise "W. C. C." to peruse "Blair's Why and Because, or the Curious Child answered," there he would find this answer. "Because the rays engage the oxygen which previously supported the fire."

I am, Sir, Yours, &c.
D. B.

CAN any of your correspondents inform me of a Cement for Glass and China? C. G.

[Dissolve an ounce of Mastic in highly rectified Spirits of Wine, soak an ounce of Isinglass in water until quite soft, then dissolve it in pure Rum or Brandy, until it forms a strong glue, to which add about a quarter of an ounce of Gum Ammoniac, well rubbed and mixed. Put the two mixtures together in an earthen vessel, over a gentle heat, when well united, the mixture may be put into a phial, and kept well stopped. When wanted for use, the bottle must be set in warm water; the glass must also be warmed and the cement applied. The broken surfaces must be kept in contract for at least a day until the cement is fully set.]

*Preparing Quills.*—SIR, will you be kind enough to inform me through the medium of your valuable little Magazine, the manner in which quills are prepared or clarified? I have tried all the recipes as given in many Cyclopædias, and have not succeeded—your reply in next number will oblige
C. D.

*Tracing Paper.*—Which is the best method of preparing Tracing Paper, for Architectural purposes? S. T. COOPER.

## TO CORRESPONDENTS.

NOTICE.—Our readers will perceive that the PENNY MECHANIC is now printed in a much smaller type than it has been hitherto. By this means we shall be enabled to give as much additional matter as if we increased the size of the work, one-fourth; and it will now contain about the same quantity of print as the *Penny Magazine.* We make this alteration because we did not wish to increase the price of the work; and although we shall of course incur an additional expense, we have no doubt it will be fully compensated by an increased sale.

"S. T. Cooper," received the Paper and Diagram. An article on "Waterspouts," shall be inserted shortly.

"R. R. Mercury." Spirits of Wine is preferable in some cases.

If "A Secretary" wishes to have the Lectures of his Society noticed, he must forward a list of them to us.

We will insert the letter respecting "A New Method of Ascending and Descending in Balloons," very shortly.

"Amateur," had better send his drawing and the particulars of the invention to the Society of Arts, Adelphi.

"A Mechanic." We shall be happy to receive the Drawing. Let the description be as full as possible.

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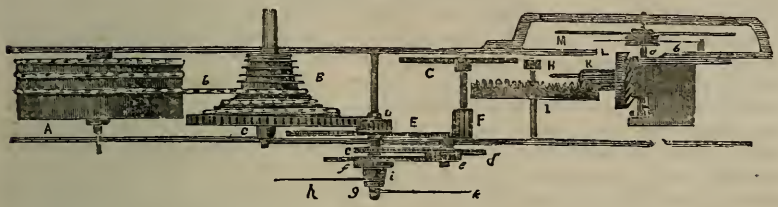
# THE PENNY MECHANIC.

A MAGAZINE OF ARTS AND SCIENCES.

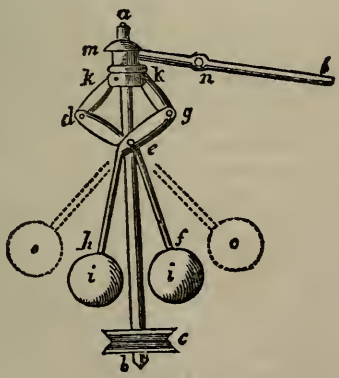
No. XIX.] SATURDAY, MARCH 4, 1837. Vol. I.

MECHANISM OF A WATCH.




BIRKBECK COLLEGE

THE GOVERNOR BALLS.






Holloway Press: D. A. Doudney.

## MECHANISM OF A WATCH.

NO. II.

Having described the different parts of a watch in our former paper on this subject in Number 16, we have now only to explain the manner in which these parts are connected with each other in order to produce the desired result, a measure of time, and our description of the mechanism of a watch will be complete. We have avoided treating the subject in any but a popular manner, because we know many persons have been frightened from inquiring into this, and many other subjects equally interesting and important, in consequence of meeting with technical terms which they could not easily understand. We have heard many persons complain of this in descriptions of the construction of watches, but we think if our readers will take the trouble to peruse the previous description we have given on this subject, they will then perfectly understand the following account of the engraving on our first page.

A is the barrel; B, the fusee; *b*, a flexible steel chain which communicates the motion of the barrel, caused by the spring within it uncoiling, to the fusee C in the great wheel; D, is the pinion (called the cannon pinion) of the second or centre wheel designed to revolve once in an hour. E is the centre wheel, containing sixty-four teeth; F the pinion of the third wheel containing eight leaves; above this is the third wheel marked C containing sixty teeth. N is the pinions of the fourth wheel containg eight leaves. This fourth wheel containing sixty teeth is marked I; and the pinion of the balance wheel, or scapement wheel, as it is sometimes called, containing six leaves, is seen at K. L is the balance wheel containing fifteen teeth, which operate upon the pallets of the balance, and give to it its oscillating motion, these pallets are marked *a a* M. The balance *b*, the hair spring; *c* pinion of ten teeth revolving once an hour; *d* wheel of forty teeth revolving once in four hours; *e* pinion of twelve teeth; *f* wheel of thirty-six teeth revolving once in twelve hours; *g* the end of the axis of the centre wheel upon which the minute-hand *h* revolves; *i* is the axis of the hour wheel upon which the hour hand goes round once in twelve hours.

All this complex machinery is confined in the small space of a pocket watch! When watches were first introduced into this country they were as large in diameter as a cheese-plate, and even larger! Yet, by the ingenuity of our mechanics, all the works have been so beautifully adapted to each other, and such great improvement has been made in their construction and arrangement, that they perform the desired operation far better than those of greater size.

We hope every one who reads this description, and possesses a watch, will look at its works, and see if he can understand their mode of action. If has been justly said that watchmaking combines more of mechanical ingenuity, with mathematical science, than any other within the circle of the arts; and therefore, if a person can understand the construction and action of a watch, he will make himself master of much that belongs to the former of these sciences, if not to the latter also.

One of the most useful improvements in the construction of watches has been the introduction of what is termed the going-fusee. By means of this the action of the works is continued whilst the watch is being wound up, although the principal spring, chain, &c. cease to have any power during this time. As it is highly important that a watch should not cease going while it is being wound up, the ingenious contrivance by which this is prevented, has proved exceedingly useful.

The watch, as we have just described it, is quite sufficient to keep correct time, provided it is always of one temperature, and has friction provided against as much as possible. The latter is effected in a great measure, in good watches, by their being jewelled; that is, having the axis of the balance wheel move on a diamond; but in order to provide against the effects produced by change of temperature more mechanism is required. It is well known that all metals are expanded by heat, and contracted by cold; and it must be evident that this expansion and contraction of the works of a watch will meterially interfere with their action, and cause the watch to indicate incorrect time. Time-pieces where this is provided against, are termed chrono-

meters. There are various methods by which the power of the spring is prevented being much influenced by change of temperature; one frequently employed is the different contracting power of different metals; the contraction of brass, for instance, being made to compensate for the contraction of steel. The perfection to which chronometers have been brought by these means is perfectly astonishing, some will not vary one second in a twelvemonth! This excellence has no doubt, in some measure, been produced by the prizes that have been bestowed on the makers of the best chronometers, but it is mainly owing to the skill and intelligence of English artizans.

## THE GOVERNOR.

The contrivance by which Mr. Watt regulated the speed of the steam-engine, and which he called the Governor, is perhaps one of the most ingenious, and at the same time simple, mechanical inventions known.

The two balls *i i* are supported by the bent levers *h e g* and *f e d*, which are attached to a vertical rod *a b*, turning on pivots at its extremities, and put in revolution by a hand passing round the pulley *c*. The upper ends *d* and *g* of the levers are connected by the links *k k* with the sliding piece *m*, which moves freely on the spindle *a b*. When the balls *i i* are in contact with the spindle, the slide *m* is at its greatest height on the rod; but when the balls diverge from the rod, as at *o o*, by the centrifugal force, the slider is depressed, and the extremity of the lever *l* moving upon a fixed pivot *n*, is proportionably elevated. This lever, being connected with the throttle-valve of the steam-engine, closes or opens it in proportion to the centrifugal force with which the balls diverge from the centre. Thus we find, that the same power which regulates the motions of the planets, and by preventing them from flying beyond their prescribed orbits, preserves the harmony of the great frame of nature, is applied, by a simple piece of mechanism, to regulate the operation of the powerful agent by which the steam-engine is moved.

It may be proper to state, that the centrifugal ball, or governor, was first employed by Mr. Bunce, and formed part of a model of an improved crane presented by that gentlemen to the Society for the Encouragement of Arts. Mr. Bunce says, "My design is, instead of a pair of bellows, to have a ball so connected to a small horizontal wheel, that when the machine moves too fast, it may, by its centrifugal force, throw a stop upon the wheel."

## UNDULATORY THEORY OF LIGHT.

The propagation of light through space, not instantaneously, but in time, established by incontrovertible astronomical evidence, leads us to one important element in the theory of its nature, a motion of progression. Other facts disclosed by experiment, principally the singular and paradoxical fact of the interferences, compel us to admit also another condition of motion combined with the last, viz., that it must be of an alternating or reciprocating nature, analogous to vibrations of some sort, since such motions alone can, by superposition, neutralize each other; this is a conclusion from facts quite independent of any hypothesis as to the particular constitution of an ethereal fluid, etc. We do not intend here, however, to enter upon any discussion of the merits of the theory of waves, but merely to offer such a general account of the researches lately made in connection with it, as may be necessary for exhibiting fairly the existing state of the question; and it is in fact one in which almost every part of the science is more or less implicated.

As, however, difficulties are felt with regard to the primary conception of the undulations, we think our readers will excuse us in presenting to them a very brief but luminous illustration of the first general notion of this theory, which we extract in the graphic and glowing language of Sir W. R. Hamilton from the introduction to one of his profound memoirs; as follows:

"This is the theory of Huyghens, who compared the gradual propagation of light, not to the motion of a projectile, but to the spreading of sound through air, or of waves through water. It was according to him, no *thing* in the ordinary sense, no *body* which moved from the sun to the earth, or from a visible object to the eye; but a

state, a motion, a disturbance, which was first in one place, and afterwards in another. As when we hear a cannon which has been fired at a distance, no bullet, no particle even of air, makes its way from the cannon to our ears, but only the aerial motion spreads, the air near the cannon is disturbed first, then that which is a little further, and last of all the air that touches us. Or, like the waves that spread and grow upon some peaceful lake, when a pebble has stirred its surface: the floating water-lilies rise and fall, but scarcely quit their place, while the enlarging wave passes on and moves them in succession. So that great ocean of ether which bathes the furthest stars, is ever newly stirred by the waves that spread and grow, from every source of light, till they move and agitate the whole with their minute vibrations: yet like sounds through air or waves on water, these multitudinous disturbances make no confusion, but freely mix and cross, while each retains its identity, and keeps the impress of its proper origin."

This then is the fundamental conception of a theory which has received fresh proof of the readiness of its application at almost every successive discovery of experimental phenomena, and which has been well characterized by Sir J. Herschel as being "in all its applications and details one succession of felicities, insomuch that we may almost be induced to say if it be not true it deserves to be so."

In a theoretical point of view, it has received its most important improvements in the hands of Young and Fresnel, and more lately from the analytical skill of M. Cauchy. This last-named mathematician has in fact remodelled it, as it were, in some of its first elements, and by this means has enabled it to apply to some most important cases where it was previously defective. In fact, to the remark just made as to the general excellence and ready application of this theory there was one grand exception, which presented an apparently insuperable objection to its admission as a real physical theory, the nature of which will appear from the following conditions:

According to the principles of undulations, a ray of light on entering a denser medium is retarded, and this precisely in proportion to the refractive power of the medium. It is a direct consequence from this, that the ray is bent from its original course precisely in that degree which is expressed by the well-known law of refraction discovered by Snell, that the sines of incidence and refraction are in a constant ratio. It is also a consequence of the theory as ordinarily conceived, that whatever we suppose to be the length of a wave, as the refraction depends solely on the diminished velocity of propagation of the waves, it ought to be exactly the same for waves of all lengths. Now the distinction between the different primary rays of light consists in their having waves or periods of different lengths, the red being longest. In the ordinary theory then the equal refrangibility of all the primary rays was a necessary consequence. And thus it was manifestly contrary to one of the most primary experimental truths. But at least no rival theory succeeded in offering an explanation at all more reconcilable with facts. The course then to be pursued was clearly to review the first elements of the theory, and to see whether they might not be so modified as that, while they continued to express as well as before all the experimental laws to which they had been found applicable, they should likewise embrace this case; this was accordingly attempted by M. Cauchy. This distinguished analyst had in several profound Memoirs (published in his Exercices de Mathématiques) investigated the mathematical conditions of a medium similar to the supposed ether of the undulatory theory. In a subsequent Memoir (entitled "Mémoire sur la dispersion de la Lumière, Paris, 1830) he pursued the ideas before laid down, and by a more refined analysis succeeded in establishing such a view of the system of undulations as included the desired *relation between the length of a wave and the velocity of its propagation.—Brit. Annual.*

## IMPROVED CONDITION OF THE WORKING CLASSES.

FIRST ARTICLE.

The industrious classes in this country

have seldom been more comfortably situated than at the present time. The price of all the necessaries of life are lower than they have been for many years, and though in some cases the wages of workmen are much less than they ought to be, yet on the whole we think the working classes generally may congratulate themselves on the improvement that has taken place in their social and political condition.

Those who have never had the opportunity of learning what their condition was a century or two ago, will no doubt be astonished to learn the abominable manner in which they were treated. Before the invasion of this country by William the Conqueror, Wade states that two-thirds of the people were either absolute slaves, or in an intermediate state of bondage to the remaining third. They might be put in bonds and whipped; they might be branded; and on one occasion are spoken of as if actually yoked: it is said "Let every man know his *team* of men, of horses, and oxen." The treatment of the people at this period, was more like that of beasts than men. The horses of the higher classes were, indeed, much better taken care of.

After the conquest their condition for a long time was not improved. They were the slaves of the owners of the soil, and as such could be bought and sold. While the people were in a state of slavery, it may be readily conjectured, that their diet would be the mere offal and refuse of their masters; and no more of it than was necessary to enable them to support their daily toil. At this period, the food of labourers consisted principally of fish, chiefly herrings, and a small quantity of bread and beer. Mutton and cheese were considered articles of luxury, which formed the harvest-home, of so much importance in ancient times. Wages were a penny a day in harvest, and a halfpenny at other seasons: the average price of wheat was 6*l.* 8*s.* a quarter, which last clearly shows the small progess made in tillage husbandry, and how little the present staff of life entered into the general consumption of the community. Their habitations were without chimneys, and their principal furniture consisted of a brass pot, valued from one to three shillings: and a bed valued from three to six shillings. The variations in the prices of commodities were great and sudden, arising from the absence of commercial middlemen, whose pursuits, though often viewed with prejudice, tend to produce a regular and equable supply of the most essential articles of consumption throughout the year. The trade of a corn-dealer seems to have been unknown; nor, except in the Abbey-Granges, do we meet with instances of corn being collected in large quantities. The natural consequence must have been, that the farmers, without capital, disposed of their crops at moderate prices, soon after the harvest: purchasers who only looked to their immediate wants, having corn cheap, were naturally wasteful and improvident in the consumption: the price, therefore, almost invariably rose as the year advanced, and was frequently at an enormous height just before harvest, when the supply of the preceding season was nearly or entirely exhausted. Stow relates, that in 1317 the harvest was all got in before the 1st of September; and that wheat which had before been at 4*l.* the quarter fell to 6*s.* 8*d.*, a twelfth part of the price. A reference to tables of prices furnish abundant proof of the extreme misery of these times, in which, the only buyers of corn were the consumers: and no monopolists, as they are termed, interfered, who by the aid of superior capital, purchasing the redundant produce of one year, made a provision for the scarcity of another.

In 1349 England was visited with a dreadful pestilence, which swept from its surface nearly one-half the inhabitants. After this terrible calamity labour became extremely dear, and labourers demanded unusual wages. To remedy this evil a proclamation was issued to fix the price of labour; this not being attended to, the famous *Statute of Labourers* was enacted to enforce obedience by fines and corporal punishment. The statute states, that since the pestilence no person would serve unless he was paid double the usual wages allowed five years before, to the great detriment of the lords and commons; it then provides that in

future carters, ploughmen, plough-drivers, shepherds, and swineherds, and other servants, should be content with such liveries and wages as they received in the 20th year of the king's reign and two or three years before; and that in districts where they had been severally paid in wheat, they should receive wheat or money at the rate of tenpence a bushel, at the option of their employers; they were to be hired by the year and other accustomed periods, and not by the day; weeders and haymakers were to be paid at the rate of one penny, mowers fivepence per acre, or fivepence a day; reapers during the first week in August twopence a day, and from that time till the end of the month threepence a day, without diet or other perquisite. Labourers of this description were enjoined to carry their implements of husbandry openly in their hands to market-towns, and to apply for hire in a public quarter of the town. This unjust interference with the freedom of industry was repeatedly confirmed by succeeding parliaments; and the same erroneous principle of legislation, further extended by the law of 1363, which regulates the diet and apparel of labourers; and that of 1388, which prohibits servants from removing from one place to another; and finally, to conclude those oppressive enactments, justices of peace were empowered to fix the price of labour every Easter and Michaelmas, by proclamation. As a specimen of the absurd system of legislation prevalent at this time, we may mention the minute regulations of the statute of 1363; which directs that artificers and servants shall be served once a day with meat and fish, or the waste of other victuals, as milk and cheese, according to their station; and that they should wear cloth of which the whole piece did not cost more than twelvepence per yard. The cloth of yeomen and tradesmen was not to cost more than one shilling and sixpence per yard. Carters, ploughmen, oxherds, neat-herds, shepherds, and all others employed in husbandry, were to use no kind of cloth but that called black russet, twelvepence per yard. Clothiers were commanded to manufacture the necessary kind of cloth, and a tradesmen to have a sufficient stock upon hand at the established legal prices!

## PROPERTIES OF MATTER.

### DIVISIBILITY.

We cannot imagine any limit to the divisibility of matter, and, speaking theoretically, it is indeed infinitely divisible, since we can conceive that every atom, however small, may be divided into two or more portions. Dr. Dalton's experiments have however pretty clearly demonstrated that the particles of matter which unite to form different substances, have a definite size, and will only combine together in certain proportions. It is of course impossible to give any idea of the size of these ultimate atoms, they are only to be seen by "the mind's eye," but the fact that they are of a definite size is placed beyond all doubt by the investigations of the philosopher just mentioned.

A few instances of the wonderful division of matter will best explain the subject.

A single pound of cotton has been spun into a thread 76 miles in length; and the same quantity of wool has been extended into a thread of 95 miles; the diameters of those threads being hence only the 350th and 400th part of an inch.

But the ductility of some metals far exceeds that of any other substance. The gold-beaters begin with a riband an inch broad and 150 inches long, which has been reduced, by passing through rollers, to about the 800th part of an inch in thickness. This riband is cut into squares, which are disposed between leaves of vellum, and beat by a heavy hammer, till they acquire a breadth of more than three inches, and are therefore extended ten times. These are again quartered, and placed between the folds of gold-beaters' skin, and stretched out, by the operation of a lighter hammer, to the breadth of five inches. The same process is repeated, sometimes more than once, by a succession of light hammers; so that 376 grains of gold are thus finally extended into 2000 leaves of 3·3 inches square, making in all 80 books, containing each 25 leaves. The metal is, consequently, reduced to the thinness of the 282,000th part of an

inch, and every leaf weighs rather less than the 5th part of a grain. Silver is likewise capable of being laminated, but will scarcely bear an extension above half that of gold, or the 150,000th part of an inch thick. Copper and tin have still inferior degrees of ductility, and cannot, perhaps, be beat thinner than the 20,000th part of an inch. These form what is called *Dutch leaf.*

In the gilding of buttons, five grains of gold, which is applied as an amalgam with mercury, is allowed to each gross; so that the coating left must amount to the 110,000th part of an inch in thickness. If a piece of ivory or white satin be immersed in a niiro-muriate solution of gold, and then plunged into a jar of hydrogen gas, it will become covered with a surface of gold hardly exceeding in thickness the 10,000,000th part of an inch. The gilt wire used in embroidery is formed by extending gold over a surface of silver.

The silk line, as spun by the worm, is about the 500th part of an inch thick; but a spider's line is, perhaps, six times finer, or only the 30,000th part of an inch in diameter: insomuch, that a single pound of this attenuated substance might be sufficient to encompass our globe.

Emery, after it has been ground, is thrown into a vat filled with water, and the fineness of the powder is distinguished by the time of its subsidence. In very dry situations, the dust lodged near the corners and crevices of ancient buildings is, by the continual agitation of the air, made to give a glossy polish to the interior side of the pillars and the less prominent parts of those venerable remains. So fine is the sand on the plains of Arabia, that it is carried sometimes 300 miles over the Mediterranean, by the sweeping sirocco. Along the shores of that sea, the rocks are covered by the pholas, a tastaceous and ebible worm, which, though very soft, yet, by unwearied perseverance, works a cylindrical hole into the heart of the hardest stone. The marble steps of the great churches in Italy are worn by the incessant crawling of abject devotees; nay, the hands and feet of bronze statues are, in the lapse of ages, wasted away by the ardent kisses of innumerable pilgrims that resort to those shrines. What an evanescent pellicle of the metal must be abraded at each successive contact! The solutions of certain saline bodies, and of other coloured substances, exhibit a prodigious subdivision and dissemination of matter. A single grain of the sulphate of copper, or blue vitriol, will communicate a fine azure tint to five gallons of water. In this case, the copper must be attenuated at least ten million times; yet each drop of the liquid may contain as many coloured particles, distinguishable by our unassisted vision. A still minuter portion of cochineal, dissolved in deliquiate potash, will strike a bright purple colour through an equal mass of water. Odours are capable of a much wider diffusion. A single grain of musk has been known to perfume a large room for the space of twenty years. Consider how often, during that time, the air of the apartment must have been renewed, and have become charged with fresh odour! At the lowest computation, the musk had been subdivided into 320 quadrillions of particles, each of them capable of affecting the alfactory organs. The vast diffusion of odorous effluvia may be conceived from the fact, that a lump of assafœtida, exposed to the open air, lost only a grain in seven weeks. Yet, since dogs hunt by the scent alone, the effluvia emitted from the several species of animals, and from different individuals of the same race, must be essentially distinct.

But the diffusion of the particles of light defies all powers of calculation. A small taper will illuminate the atmosphere to the distance of four miles; yet the luminous particles, which fill that wide concavity, cannot amount to the 5000th part of a grain, which may be the whole consumption of the wax in light, smoke, and ashes.

It is not, however, inanimate matter alone that is capable of such minute division. There are some organized beings thousands of which can be raised on the point of a pin! Such is stated to be the fact by many eminent microscopic observers, and after reading the previous instances of the minute subdivision of unorganized bodies, the one circumstance does not certainly appear more extraordinary than the other.

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## MISCELLANIES.

*Greenwich Railway.*—A very stupid hoax was last week practised upon the public respecting this railway, by some stock-jobbers, we suppose, who wished to purchase shares. It was reported, that Mr. M'Intosh, who is a creditor of the company's, had seized the carriages, &c. on the train, turned off the men employed by the company, and, by virtue of a writ of execution, taken the management of the whole concern into his own hands. A more foolish statement could hardly have been made, and of course, very few sensible persons were deceived by it, before the solicitor of Mr. M'Intosh had written to the Newspapers, explaining that the whole was a fabrication. These silly jokes, however, very often occasion much mischief.

*Mr. Crosse's Experiments.*—Our readers will recollect that a Number or two back we inserted a paragraph from the newspapers, in which it was stated, that Mr. Crosse had formed some insects of a peculiar character by means of Galvinism. We intimated our disbelief of this story, and it has since been admitted to be incorrect. It appears, however, that some small living creatures did make their appearance; and the experiments, to which those of Mr. Crosse have given rise, have certainly produced results that could not have been anticipated. Dr. Faraday, when lecturing at the Royal Institution, a few days since, stated "that he had himself obtained an insect, or rather animalculae, by a continuous voltaic stream from silica of potass." He also exhibited some insects obtained from hard polished stone, and which, like those of Mr. Crosse, appear to have been restored to life after remaining in a dormant state for centuries, or thousands of years. The subject will now no doubt receive due attention from scientific men, and we may expect some extraordinary discoveries.

*Vegetable Substance in Arsenic.*—It has been generally supposed that arsenic was so strong a poison, that it would entirely destroy organic life. M. Gilgen Krantz, however, chief surgeon to the third regiment of Engineers in France, who has been very successful in his studies concerning aquatic cryptogamia, has discovered a vegetable substance of the genus Leptomitus, or Hygrocrocis, in a solution of arsenic. M. Dutrochet also observed one of the same genus in a phial of Goulard water. In both cases the plants floated in the liquid.

## INSTITUTIONS.

*London Institution.* Finsbury Circus.—Monday, March 6, C. C. Clark, esq., on the early British Poets, at seven o'clock.

*Aldersgate-street Institution*—Wednesday, March 8, at eight, T. J. Searle, esq., on the Drama.

*Western Literary and Scientific Institution*, 47, Leicester-square.—Thursday, March 9, at half-past eight, Mr. Buckingham, M. P., on Oriental History.

*Eastern Athenæum*, Stepney Square.—Wednesday, March 8, N. F. Zaba, esq., on Polish Literature, at eight.

*Islington Literary and Scientific Society.*---Thursday, March 9, Mr. T. Cromwell, on the Archeology of the British Islands, at eight.

*Westminster Mechanics' Institution*, Grosvenor St., Millbank Row.—Wednesday, March 8, S. Logan, esq., on Phrenology, at eight.

*Kentish Town Mechanics' Institution.*—Monday, March 6, F. H. Showler, esq., on the Circulation of the Blood, at eight.

*Poplar Institution*, East India Road.—Tuesday, March 7, S. Logan, esq., on Phrenology, at eight.

### TO CORRESPONDENTS.

"T. W. Ritchie." We intend to give an engraving and description of the machine shortly, and have not therefore thought it necessary to insert his query.

The paper "on Accidents from Cleaning Windows improperly." we will find room for.

"W. C. C.'s" letter was overlooked, or we should have acknowledged the receipt of it. We are much obliged for the answer, but the letters that have already appeared are sufficient.

"Swolby." If we receive a satisfactory answer to his query we will insert it.

The "Answer to the Letter on the Results of Machinery," next week.

"Mr. Clements'" papers and illustrations in a Number or two.

The letter "on accidents from Fire and Shipwreck" has been received, and shall have our early attention.

"S." Hydrogen Gas although itself inflammable, will not support combustion. If a lighted candle be suddenly plunged into a vessel containing this gas, it will be immediately extinguished.

"Critic." The word should have been *think;* it was not a grammatical error, but the word was overlooked when read.

"The Report of the Quarterly Meeting of the London Mechanics' Institution" in our next.

"N. N." We are much obliged. He need not have made any apology for the composition of his letter, as we have invited, and shall always be happy to receive, communications from practical men on subjects calculated to improve their fellow-workmen or the public generally.

A monthly part is published, stitched in a wrapper, price *Fourpence.*

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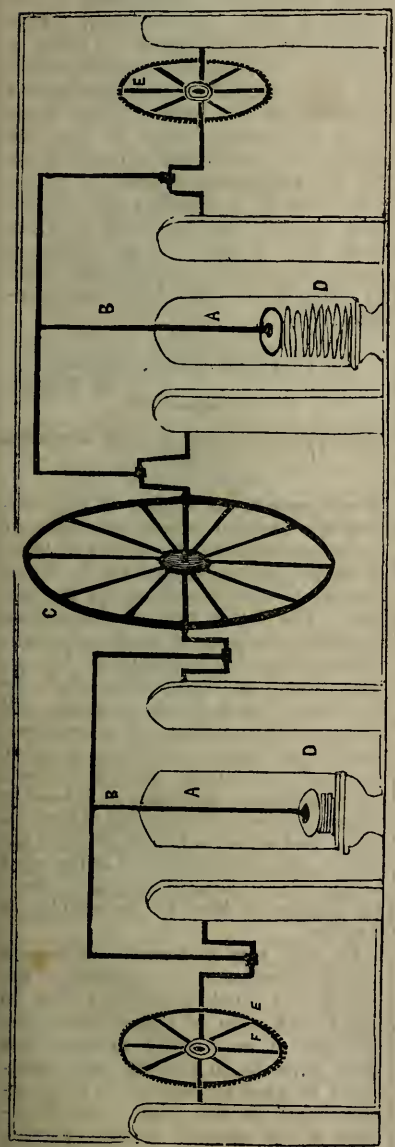
# THE PENNY MECHANIC.

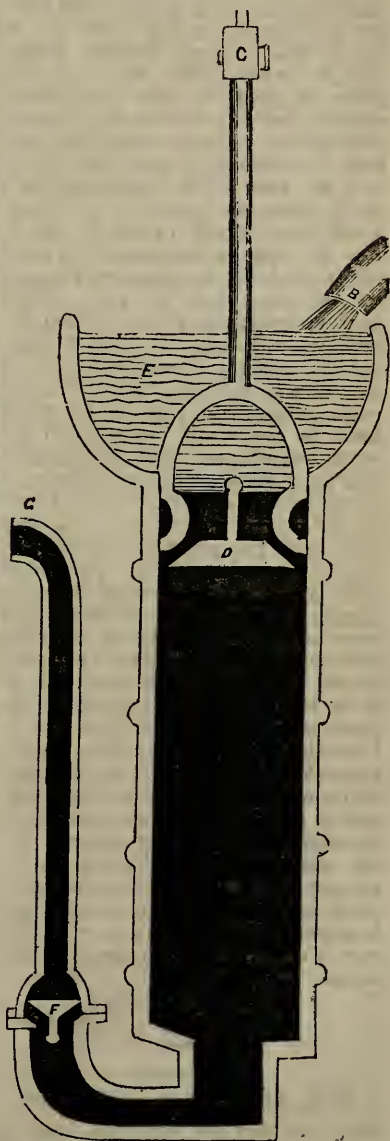
A MAGAZINE OF ARTS AND SCIENCES.

No. XX.] SATURDAY, MARCH 11, 1837. Vol. I.

PERPETUAL MOTION.




KING'S FORCE PUMP.






Holloway Press: D. A. Doudney.

## KING'S FORCE PUMP.

*To the Editor of the Penny Mechanic.*

SIR,—I send you herewith the drawing of a plan for a Force Pump I have invented, which may be of service to some of your numerous readers. It will be applicable to a beam engine where there are two pumps, viz. force, and lift, so for the lift, to supply the force pump; also for water-closets, &c. C is the piston or pump-rod, to which is affixed a bucket just the reverse to the lift pump with valve D. F is the valve which supports the column of water within pipe G. E is the water which is contained in a small cistern on the top of the pump, which is kept supplied from the pipe B. Now the water in the cistern will naturally rush down the pump and force up the valve F, and up the pipe G till it finds its level; the piston rod then descending, will force the valve D close, and the pressure of water will force up the valve F, and force still further the water contained in pipe G; the water from the cistern will descend with the piston and plunger, which having gone its regular distance will ascend, the valve F will drop to support the water forced up the pipe G, the valve D will drop down having no pressure underneath to support it up, also, having a pressure of water above what descended with the plunger, the water above will occupy the space of the water forced up until the plunger descend again, then it will force up the valve F, and will continue to do so as long as motion is given and the pump supplied with water from pipe B. I consider that this pump will not require so much power to work it as those now commonly in use, as the plunger descends the body of water contained in the cistern will naturally descend, also the weight of water bearing on the plunger will assist greatly in forcing the water up the pipe G, and where it may be required. If, Sir, you consider this worthy of your notice the insertion will oblige

Your Subscriber, &c.

JOHN KING.

## LAND SKATES.

*To the Editor of the Penny Mechanic.*

SIR,—An idea has suggested itself to me, that it is possible to propel yourself along a smooth and level plane, by means of an article which I would designate by the name of *Land Skates*, and the way that I propose is this:—

These land skates are to be made precisely in the same manner as other skates, with one exception, which is, that instead of having a piece of iron or steel running along the bottom of them, a single row of small brass or iron wheels is to be substituted, which might be half imbedded in the wood. These skates are to be buckled round the legs the same as any others, and it occurs to me that you might keep yourself in motion with them on a smooth surface, in the same manner that you would were you upon ice. Whether I am right, or wrong, remains for me to be told, either by yourself, or your kind correspondents.

I am, Sir,
Your most Humble Servant.
H. BAKER.

## IMPROVED CONDITION OF THE WORKING CLASSES.

SECOND ARTICLE.

WITH respect to wages, if any unemployed person refused to serve at the wages fixed by the statute of 1496, he might be imprisoned till he found sureties to serve according to the statute. The latter part of this statute regulates the hours of work and meals, by providing that the hours of labour, from March to September, shall be from five o'clock in the morning, till seven in the evening; that one hour shall be allowed to breakfast, an hour and half for dinner, and half an hour for *noon-meate:* the hours of labour in winter are from "springing of day" to dark, and only one hour is allowed for dinner, the extra half-hour at the meal being only allowed for sleeping, from the middle of May to the middle of August.

By such acts of tyranny as these it may be imagined the condition of the people was much depressed; even so late as the reign of Queen Mary, the dwelling of an English peasant was little superior in comfort and cleanliness to what we observe in the clay-built hovels of the Irish. The dwellings of the common people, according to Erasmus, had not yet attained

the convenience of a chimney to let out the smoke, and the flooring of their huts was nothing but the bare ground: their beds consisted of straw, among which was an ancient accumulation of filth and refuse, with a hard block of wood for a pillow. And such in general was the situation of the labouring classes throughout Europe. Fortescue, who wrote in the reign of Henry VI., speaking of the French peasantry, says, "Thay drink water, thay eate apples, with bread right brown, made of rye; thay eate no fleshe, but, if it be selden; a littell larde, or of the entrails or heds of beasts, sclayne for the nobles or merchaunts of the lond."

Coming down to a later period, we find the relation between wages and price of food, the best criterion of the condition of the working classes. Hume remarks, in his History of England, that he had not been able, by any inquiry, to learn the common price of butcher's meat during the reign of James the First. Mr. Birch, however, in his "Life of Prince Henry," published in 1760, states the prices paid for flesh, by the purveyor of the prince's household, about the beginning of the seventeenth century, from which it appears that the price of beef was about $3\frac{3}{4}d.$, and of mutton about $3\frac{3}{8}d.$ per pound. At the same time, wheat was 50*s.* the quarter, butter 6*d.* and loaf-sugar 1*s.* per pound; while the highest wages of agricultural labourers were 10*d.* per day, without food, the majority being paid only 6*d.* to 8*d.*, and women earning no more than 5*d.* per day. The daily wages of artificers varied at this time, according to their skill, from 8*d.* to 1*s.*; a master carpenter alone, who directed the labours of others, obtained as much as 1*s.* 2*d.* Under these circumstances, it is clear that the industrious classes were but little able to command the use of those articles of consumption which now form so large a portion of their constant food. Wheaten bread was, in those days, a luxury confined to the use of the nobility and gentry. Even the household servants, in great families, were not provided with such delicate food, but were forced to content themselves with rye bread and oatmeal. Potatoes, now so extremely common, were then scarcely known, and cost 2*s.* the pound, being provided, as a great delicacy, for the table of his majesty. Even so late as 1725, but little more than a century since, the wages of labour had made little or no advance upon the rates just mentioned. The best husbandry labourers in the county of Lancaster were limited, in that year, by the justices of the peace in quarter-sessions, to 1*s.* per day, and "the ordinary sort" of such labourers received only 10*d.* without meat and drink; where food was supplied by the employer, only half these rates were paid. Women employed in haymaking received 7*d.* per day, without food, and only 3*d.* with it. Masons, carpenters, and the like kind of artificers, were limited to the daily pay of 1*s.*, and had no more than 6*d.* when meat and drink were allowed. The master workman, who had others serving under him, had 2*d.* added to this rate. A master tailor had no more, however, for his daily wages, than 1*s.* without food, and his journeymen were paid only 10*d.* At this time the prices of provision appear to have been very nearly the same as they were a century before; and during all that time the condition of agricultural labourers and artificers, in the distant parts of the kingdom, must have continued very stationary. A marked improvement in their situation appears, in the meanwhile, to have been secured by them in or near the metropolis. From the tables, kept at the Royal Hospital, Greenwich, of the contract prices of provisions and clothing purchased for the use of that establishment, as well as of the daily wages paid to such artificers as were employed therein, we learn that, in 1730, the price of meat was $2\frac{3}{4}$. per pound; that the cost of wheaten bread was equal to $6\frac{1}{8}d.$ for the four-pound loaf; that butter was $4\frac{1}{2}d.$ and cheese $3\frac{1}{8}d$ per pound; oatmeal 4*s.* 6*d.* per bushel; candles were $6\frac{1}{2}d.$ per pound; shoes 4*s.* per pair; coals 28*s.* 5*d.* per chaldron; stockings 1*s.* 9*d.* per pair; and hats 2*s.* 8*d.* each. At this time, carpenters, bricklayers, and masons, were paid each half-a-crown per day; joiners had 2*d.* additional, and plumbers received 3*s.* It must be borne in mind that the prices here given are those for which

a great establishment was able to purchase large quantities of each description of food and clothing, and that the retail prices, especially to persons whose limited means obliged them to buy only small quantities, would be considerably dearer.

After comparing these times with the present, we say with a late writer, who will deny that the labouring artizan of the present day, in England, finds within his reach more and greater comforts than were enjoyed by the most powerful lords in feudal times? The products of the Indies are to be found on his table; the materials of which his cheap and comfortable dress is made come in a great part from places, the very existence of which was unknown to our ancestors; and by the inventions of ingenious men, the prices of manufactured goods have been so materially reduced, while their qualities have been so importantly improved, that scarcely any persons are so destitute as to be unable to provide themselves with decent and appropriate clothing. The cottages of our working artizans are, most of them, provided with articles of furniture which, although now so common that the want of them would be considered a hardship, were wholly unknown in the days of Elizabeth; and we have long since ceased to apprehend,—at least in this part of the kingdom,—a recurrence of those dearths which, in former times, brought misery and disease in their train, to a degree and with a frequency which thinned the ranks of the industrious classes, and impeded the progress of the community at large. This improvement, which is rendered glaringly apparent by thus contrasting distant periods, has not been brought about by any sudden or accidental causes, but has been steadily progressive. It would not be very difficult, however, to show that its progress has been more rapid during the last century than in any preceding equal number of years; and that, of this period, the twenty years just elapsed, during which Europe has been blessed with peace, have witnessed, in this country, the most rapid strides towards a general amelioration in the condition of all classes of the community.

## ADVANTAGES OF MACHINERY.

There exists, perhaps, no single circumstance which distinguishes our country more remarkably from all others, than the vast extent and perfection to which we have carried the contrivance of tools and machines for forming those conveniences of which so large a quantity is consumed by almost every class of the community. The amount of patient thought, of repeated experiment, of happy exertion of genius, by which our manufactures have been created and carried to their present excellence, is scarcely to be imagined. If we look around the rooms we inhabit, or through those storehouses of every convenience, of every thing that man ean desire, which deck the crowded streets of our larger cities, we shall find in the history of each article, of every fabric, a series of failures which have gradually led the way to excellence; and we shall notice, in the art of making even the most insignificant of them, processes calculated to excite our admiration by their simplicity, or to rivet our attention by their unlooked-for results.

The accumulation of skill and science which has been directed to diminish the difficulty of producing manufactured goods, has not been beneficial to that country alone in which it is concentrated; distant kingdoms have participated in its advantages. The luxurious natives of the East, and the ruder inhabitants of the African desert, are alike indebted to our looms. The produce of our factories has preceded even our most enterprising travellers. The cotton of India is conveyed by British ships round half our planet, to be woven by British skill in the factories of Lancashire: it is again set in motion by British capital; and, transported to the very plains whereon it grew, is repurchased by the lords of the soil which gave it birth, at a cheaper price than that at which their coarser machinery enables them to manufacture it themselves.—*Babbage.*

## PATENT LAW.

An Act has been passed in the Session of Parliament 1835, to do away with some of the defects with which our antiquated Patent Laws are encumbered; and although it does not pretend to an entire removal of the causes of complaint, yet considering the admitted difficulties of the case, and the very objectionable nature of some of the former propositions for amendment, we are not sorry that the work of improvement has been begun

with caution; at the same time we wish to consider what has been done only as a beginning, and hope it will lead the way to a general amelioration.

One great grievance of the system, was the destruction of all right to a patent which resulted from an inadvertent claim put in to any part of an invention which might not actually be new, although that circumstance should be unknown to the inventor, and even although the part claimed should be a small and unessential portion of the whole invention. To make this matter clear, it must be stated that, in explaining the nature of an invention, such as a machine for instance, the patentee is compelled to describe the construction of his invention in the fullest detail, so as to enable an ordinary workman to construct a similar machine. As in every such new invention, certain parts must almost necessarily be well known, certain wheels and levers will be like wheels and levers in other machines; and as to these wheels and levers the patentee can have no exclusive right, he is expected to declare in his specification what parts of the machine he claims as his own invention. To these alone he has exclusive right; all other parts are public property, and may be used by any one. Thus far all is right; if it were otherwise, a patentee might be allowed a right to what is not his own. The grievance complained of is, that if a patentee should inadvertently lay claim to any part of his new invention, which part might afterwards be found not original, he lost not only his right to an exclusive use of that one part, but to the entire invention, however new it might be. He was thus cooped up in a dilemma; if he did not claim the whole of his invention, from a fear of overclaiming, he of course lost his right to that which he did not claim: if, on the contrary, he claimed all which was his own, and it should be found that some part was not original, then he lost his whole patent. The motive to this severity seems to have been the wish to prevent by a penalty an unprincipled schemer from endeavouring to appropriate to himself more than his own. But while the schemer was punished, the honest inventor was often a sufferer. A new machine might have great merit, it might in principle and action be perfectly new; but some of its details might have been used in some other machine now in disuse, quite unknown to the inventor. This is discovered by some rival manufacturer, and the patentee loses his right. By the act now passed, this grievance is done away with; if a patentee should be in the situation supposed, if he should find that some portion of his invention has been anticipated, he may now, on a proper representation, obtain leave to enter and enrol a disclaimer of such portion, and remain in the situation he would have been in, had no such claim ever been put forward.

It has been objected to this alteration, that advantage may be taken of it by a dishonest schemer, who may take out a patent for an invention not his own, and then, as he finds himself discovered, enter a disclaimer, first to one part and then to another, as such parts are objected to, and in the mean time reap all the advantage of his patent, as though the invention were his own. This we imagine is an impossible occurrence; it must be remembered that the enrolment of the disclaimer is not a matter of right, that it may be refused by the Attorney-General, unless a sufficient cause is alleged for the alteration, and that in case of fraud it would undoubtedly be refused. There is also another check, and a strong one, against such a practice: the disclaimer cannot be received in evidence, in case of an action brought before such disclaimer was enrolled. A patentee, therefore, who should make an overclaim, and against whom an action should be brought in consequence of that overclaim, will, as far as that action goes, stand precisely in the situation he would have stood in before the new act was passed. He will be liable to the same penalties, and be put to the same expense in the suit. The only difference is, that he will be enabled to protect himself from the loss of his whole patent in such a case, and will stand upon his own right in future. Now an honest patentee will, it is true, suffer in the immediate action the penalty of his inadvertence, but no more. The dishonest one will render himself liable to the same penalty, as often as he shall attempt to make use of any right given him by a fraudulent claim.

The second clause enacts, that if a patentee shall have reproduced some old

invention, believing himself to be the inventor, it shall be in the power of the crown, upon a recommendation of the Judicial Committee of the Privy Council, to continue the patent to the patentee, wherever it shall appear that the invention has not been publicly and generally used. It is feared by some persons that all kinds of old inventions will be brought up again and promulgated as new, under favour of this clause, and that every body will be taking out patents for old and abandoned projects. This appears very absurd. To say nothing of the expense of taking out patents, and the almost certainty of their being useless to the patentee (for we may be well assured that in ninety-nine cases out of a hundred the inventions would not have been abandoned if they had not been useless), there are so many checks against the continuance of such patent by the crown to any but a *bonâ fide* re-inventor, that few persons will feel inclined to rake out old books for the purpose of picking up lost inventions. If any person should be lucky enough to re-produce an invention of value abandoned from any cause, and generally forgotten, we see no harm in his having the monopoly of its use for a few years as a recompense for his bringing to light a valuable idea, though we would rather he should be entitled to it without any misrepresentation.

The third clause contains a provision against the repeated vexatious actions by which a patentee might be put to enormous law expenses under the former act. Before the passing of the new law, although an action respecting the validity of a patent might be decided in favour of the holder of the patent, this verdict was no bar to a future action, nor to any number of future actions. Although nothing new could be alleged, although it was but going over the same ground again and again, the patentee might be compelled year after year to defend himself against fresh actions, to his great injury, perhaps to his ruin. The clause enacts, that in any action respecting the validity of a patent, if a verdict pass in favour of a patentee, the certificate of the judge who tried the action may be adduced in evidence on any future action; and if the verdict in such subsequent action be given in favour of the patentee, he shall receive treble costs.

By the fourth clause, an extension of the term of a patent, not exceeding seven years, may be granted by his Majesty, on a recommendation of the Judicial Committee of the Privy Council, who may call and examine witnesses in the case of a petition for extension. This is decidedly an improvement: the term of fourteen years granted indiscriminately by every patent, is too short in some cases to render any profit to an inventor, and this chiefly in those inventions of great value which require time to introduce. We may instance Watt's improvements on the steam-engine, which from prejudice and other causes were hardly in general use when the term granted by his patent expired. By the old act, no extension could be obtained without an application to Parliament, which has attended with so many difficulties that it nas been rarely resorted to.

The fifth and sixth clauses refer to the manner of conducting trials for infringement of patent rights, and regulate the costs in such actions. The last clause inflicts a penalty upon any person putting the name or mark of a patentee upon any article without his permission.—*Companion to Almanack*, 1836.

In No. XII. of the Penny Mechanic, we have given an abstract of the act.

The expense of taking out a patent has often been loudly complained of. Several correspondents have written to us requesting to be informed the exact expense; this it is not possible to give, since it varies for different patents. When a select committee of the House of Commons sat in 1829, it appeared from the evidence of witnesses examined before it, that the expense of taking out a patent for England amounts to about 107*l.*; for Scotland about 80*l.*; and for Ireland about 128*l.* It will be considerably greater, however, in each case, should any opposition be made. To these sums must also be added the expense of the specification, which is generally drawn up by a professional adviser, and costs more or less, according to its length. "I have had them," says Mr. Farey, the engineer, "as high as 200*l.* for one very intricate invention, where there were patents for all three kingdoms; and from

that to as low as three guineas." The average charge he reckons as amounting to about 20*l.* Another witness, Mr. Moses Poole, one of the clerks in the Patent Office, mentions 960*l.* as about the whole expense of taking out patents for the three kingdoms, "if with a short specification, and no opposition." A third, Mr. Samuel Morton, who had been connected with his brother in taking out a patent for a slip invented by the latter for hauling ships out of the water, states that the three patents for England, Scotland, and Ireland, including agency, cost about 450*l.*

## PERPETUAL MOTION.

*To the Editor of the Penny Mechanic.*

SIR,—I sometime ago sent you a diagram of a steam boiler, which I saw answered in your valuable Magazine, that it should be attended to, which I thank you for, I now wait upon you with an article of quite a different nature. This is a diagram of a perpetual motion; I hope you will find a place for it in your magazine, and at the same time, that it will meet with your readers approbation. The machine represented in the first page will require but little trouble: it will only be necessary to keep the works clean, indeed, all kinds of machinery require this, for there is nothing like cleanliness in any thing. Although the machine is not so powerful as one moved by steam, nor do I say it would supply the use of steam, yet for little power it might be useful, or perhaps only for curiosity; or for raising water; or for a grocer in turning a mill; in this case it really might be useful. I am not one of those who descant too much upon the properties of their articles, but say what is fair in stating what it might be useful for. It is simple enough in its construction. The first cause of its motion is the spring D in the tube A, which acts against the piston B, which sets in motion the fly wheel C. On the otherside are also the same works; when the spring D is at its full extent on the right side, it is down on the left, as seen in the diagram, therefore always keeping one spring down, as when rising to force the wheel C round, while it forces the other spring down, so that while one spring is rising, the other is falling, and keeping up a constant succession; which, if only one spring, would be likely to stop itself when the spring was at its full extent; or, indeed, if both springs acted at once the consequence would be that double the strength would be then added, and it would be still more likely to check itself; but this is rectified by one rising, and the other falling, which keeps up the perpetual motion, and turning the wheel E, which is toothed, so as to act upon any other machinery, indeed it would work two machines at once by adding the wheel F E.

Your most Obedient Servant,
J. W. RITCHIE, JUNIOR.

## MISCELLANIES.

*British Museum.*—Our readers will no doubt be gratified to learn that in future the British Museum will be open to the public during the whole of the Easter, Whitsun, and Christmas holiday weeks, except Saturdays. The injustice of preventing the working classes having admission to the National Museum, during the only time when they could do so without inconvenience to themselves, was only equalled by the absurdity of expecting by this impolitic measure, to prevent injury being done to the curiosities preserved in the museum; for it is evident that if persons were inclined to be mischevious, they could gratify their propensity at other times, when there would be no restriction with respect to who should be admitted. For all that is said about the mischievious disposition of the English people, and their propensity to disfigure and injure works of art, it is a fact deserving notice, that while the managers of the British Museum have never had to complain of improper conduct of this kind, although there is no charge for admission, yet the Literary Gazette a short time since uttered a furious anathema against certain persons, who it seems have nearly carried away the "mast of the Victory," (Lord Nelson's ship) in Windsor Castle, by breaking off small pieces as "tokens," and these persons had to *pay* highly for the gratification of their curiosity. We do sincerly hope that the trustees of the British Museum will not stop in their reforms; but that before long the reading rooms will be opened to the public in *the Evening.*

*Gas Reflectors.*—Most of the Gas-lights in respectable shops, particularly those of stationers and linen-drapers, have a tin reflector placed round the glass of the gas-burner, for the purpose of throwing the light on the goods in the window beneath. This is a great improvement, but if the tin reflectors were made *concave* instead of flat, the light would be much more powerful than it is at present. More of it would be reflected downwards.

*Preservation of Iron from Rust.*—A mastic or covering for this purpose, proposed by M. Zeni, and sanctioned by the Societé d'Encouragement, is as follows: eighty parts of pounded brick, passed through a silk sieve, are mixed with twenty parts of litharge: the whole is then rubbed up by the muller with linseed oil, so as to form a thick paint, which may be diluted with spirits of turpentine. Before it is applied the iron should be well cleaned. From an experience of two years, upon locks exposed to the air, and watered daily with salt water, after being covered with two coats of this mastic, the good effects of it have been thoroughly proved.

*Purifying Dwellings.*—The following is Dr. J. C. Smith's recipe for purifying houses where contagion is supposed to exist, for the discovery of which that gentleman received a parliamentary grant of 500*l.*—Take six dr. of powdered nitre, six dr. of oil of vitriol, mix them in a tea-cup, by adding to the nitre 1 dr. of the vitriol at a time; the cup to be placed, during the preparation, on a hot hearth or plate of heated iron, and the mixture stirred with a tobacco-pipe or glass rod; the cup to be placed in different parts of the contaminated chamber.

*State of the Atmosphere in London.*—It is reported in the *Journal des Connaissances Usuelles et Practiques*, that M. Darcet, while in England, having discovered effects in London, with reference to the buildings, which he considered could only be produced by sulphuric acid in the atmospheric air, he attached to his hat every morning, before going out, a piece of paper, made blue by turnsol, which was very soon changed to red; whilst similar pieces, that were exposed only for a few moments to the influence of the air, became studded by a great number of small red points. During the whole of his stay in London, M. Darcet renewed his experiments every day, which were attended with the same result, and he carried with him to Paris, on his return, a great number of the small pieces alluded to. The sulphuric acid is attributed to the coal.—*Repertory of Patent Inventions.*

## INSTITUTIONS.

*The Meteorological Society* will hold its Anniversary Meeting on Tuesday, 14th instant, at eight P.M.

*London Institution*, Finsbury Circus.—Monday, March 13, at seven, C. C. Clark, esq., on early British Poetry.—Thursday, March 16, H. J. Gauntlett, esq., on Music.

*London Mechanics' Institution*, Southampton-buildings, Chancery-lane.—Wednesday, March 15, Mr. Cowper, on Weaving.—Friday, 17, Mr. Wood, on Perspective. Both at half-past eight.

*Aldersgate-street Institution*—Wednesday, March 15, at eight, T. J. Searle, esq., on the Drama.

*Western Literary and Scientific Institution*, 47, Leicester-square.—Thursday, March 16, at half-past eight, Mr. Buckingham, M.P., on Oriental History.

*Eastern Athenæum*, Stepney Square.—Wednesday, March 15, at eight, N. F. Zaba, esq., on Polish Literature.

*Islington Literary and Scientific Society.*—Thursday, March 16, at eight, Mr. Dowoos, on the Archeology of the British Islands.

*Poplar Institution*, East India Road.—Tuesday, March 14, at eight, B. R. Haydon, esq., on Painting.

*Society of Arts*, Adelphi.—Tuesday, March 14, at eight, J. Taylor, esq., on Mining.

*Westminster Mechanics' Institution*, Grosvenor St., Millbank Row. — Wednesday, March 15, at eight, R. F. Showler, esq., on the Circulation of the Blood.

*Kentish Town Mechanics' Institution.*—Monday, March 14, J. Smith, esq., on the Essentials of General Happiness.

*Bermondsey Mutual Instruction Society.*—Monday, March 13, at eight, Mr. L. Rickard, on the Steam Engine.

## TO CORRESPONDENTS.

We have not received either of the three circulars of the "Tower-street Society," or the notices should have been inserted. There must be some mistake, we think.

"J. C. P." has our thanks for his communication. The invention, although ingenious, having, however, previously appeared in a similar publication, prevents our making use of his letter.

"W. Clements" received. It shall be attended to.

"N. N." Coal gas is carburetted hydrogen.

We are sorry to be obliged to postpone the letter on the "Results of Machinery," but it takes up more room than we can possibly spare this week.

"Query." Any Encyclopædia will afford our Correspondent the information he requires. We cannot spare room, or we should be happy to answer his question at length.

"S. S." We have many times received letters similar to that of our Correspondent; and several of the papers have also suggested our increasing the size and price of THE PENNY MECHANIC. The subject, however, requires consideration. Although there would be advantages attending an increased size, there would also be some disadvantages.

The Monthly Part of THE PENNY MECHANIC is published at Four-pence. The Cover and Index is not charged for.

All communications intended for the Editor should be addressed to *him*, and not to the *Publisher*. Some of our Correspondents have made a mistake in directing to the latter Gentleman.

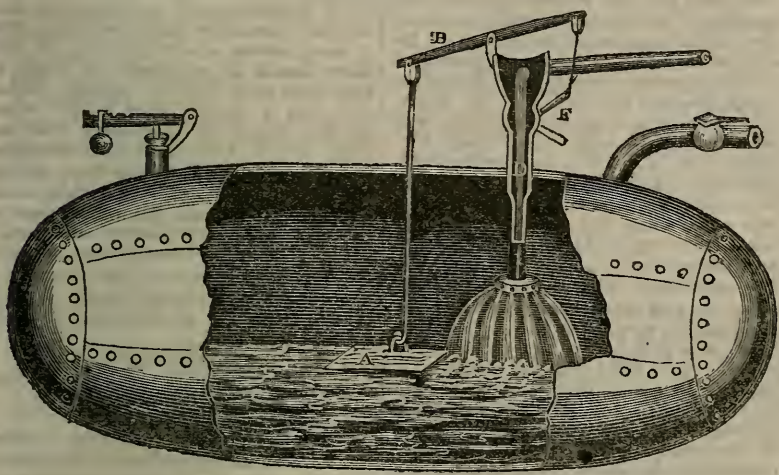
London: Printed at the Holloway Press, by D. A. DOUDNEY; published by BERGER, Holywell-street, Strand; and may be had of all Booksellers.

# THE PENNY MECHANIC.

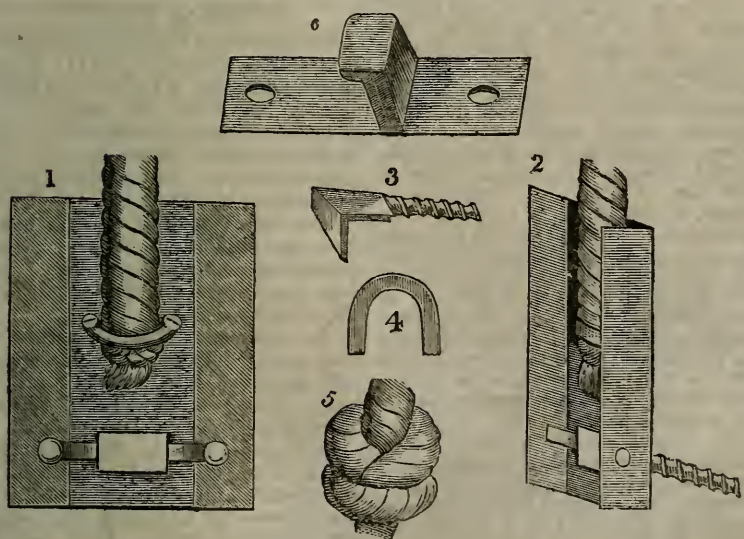
A MAGAZINE OF ARTS AND SCIENCES.

No. XXI.] SATURDAY, MARCH 18, 1837. Vol. I.

KING'S STEAM BOILER.




NEW PLAN FOR HANGING WINDOW-SASHES.






Holloway Press: D. A. Doudney.

## THE STEAM BOILER.

*To the Editor of the Penny Mechanic.*

SIR,—In reference to my remarks on Mr. Douglas's Steam Boiler, your reader, Mr. J. F. Puttich, in No. 16, states, that he thinks my "arrangement of the water valve will not tend to ameliorate the bad qualities of Mr. Douglas's invention, in so great a degree as could be wished, if indeed at all. For, as the heat is continued and the expansive force of steam increased, it will press on the surface of the water, which having no other way of escape, will be forced up the pipe F (see "Penny Mechanic," fig. 1, p. 65), and produce the same effects as Mr. King stated would be the result if the pipe F were above the surface of the water, viz., force up the water valve, &c." Mr. J.F. Puttich thinks that my arrangement would not ameliorate the bad qualities of Mr. Douglas's invention; now I not only think, but have the greatest confidence it would, for, as Mr. Douglas's boiler is supplied by a pipe connected at one end on a level with the bottom, my mode is for a pipe to descend below the surface of the water, so that the pressure of steam shall be according to the diameter of the pipe; and the water continually descending the pipe will cool the water in a great measure within the pipe, so that there will be scarcely any pressure of steam rising within it. Mr. Puttich says, "that the steam having no other way to escape will be forced up the pipe F;" what, then, would Mr. Puttich shut the communication to the cylinder, and would he do away with the safety valve? or would he tie or otherwise load the safety valve, so that it would be beyond the power of steam to force it up? If Mr. Puttich intends doing this, I coincide with him, that having no other way to escape, the steam would naturally press on the surface of the water, and the water would be forced up the pipe F, provided the boiler is sufficiently strong to sustain the pressure; but I leave it to your readers to judge what manner of use a boiler of this description would be, having no way for the steam to escape, not even to work the engine, or to escape when beyond a certain pressure, out of the safety-valve.

Mr. Puttich goes on to remark, that to remedy this, he proposes that the pipe F should be above the surface of the water, having a cock connected with the pipe, as seen in No. XVI., p. 124. I consider this would not answer the intentions of Mr. Puttich, as the cocks are made of brass; and as that metal is a great conductor and retainer of heat, the cock would consequently be exposed to the full action of the steam, which would be a very great heat. Now the cock, being greatly heated, would naturally expand, and cause it to go stiff, and perhaps make it set fast; which, if it did so, would prove very dangerous. To remedy this evil of Mr. Puttich's improvement, I would propose that the cock should be above the boiler, with a small cistern above the cock, so that there should be a quantity of water to keep this cool. (See Engraving.) When the float A descended it would cause the float end of the small beam B to descend with it; this would cause the other end to ascend, which would draw up the handle F; the water would then rush down the pipe D, and through the rim at bottom, which is perforated with small holes. The water would thus be dispersed, similar to rain. I have drawn the water lower than what it should be with safety, in order to show the operation of my improvement.

Your Subscriber, &c.
JOHN KING.

*No. 8, Lucretia-street,*
*Lambeth-walk.*

*** The latter part of Mr. King's letter was not sufficiently explanatory; we have therefore taken the liberty of omitting it. ED. P. M.

## RESULTS OF MACHINERY.

*To the Editor of the* PENNY MECHANIC.

SIR,—Observing in No. XVIII. of your useful publication, a Letter to the Editor, headed "Results of Machinery," I beg to intrude upon your attention in reply to the conclusion drawn by your Correspondent; viz., that machinery, "by performing his work, injures the labourer, and necessarily deprives him of his means of subsistence," and "that the introduction of machinery has always been more prejudicial than otherwise to the *Working Classes.*"

An examination of the real state of the case, on the introduction of machinery, will show that the "results" are the very opposite to those stated by your Correspondent.

A manufacturer, by the introduction of a machine, is enabled to dispense with the labour of fifty of his workmen, and thereby save the amount of their wages, say 3000*l.* per annum. How does the capitalist employ the money saved? Does he throw it into the sea, or bury it in the earth? No; he employs it again in

his particular trade, and thereby swells his income. Or he increases the comforts and luxuries of his home. In which ever way he uses the capital saved by the machine, whether in enlarging his factory, or by building a new one, or by increasing his stock in trade, or by purchasing superior furniture for his house, or setting up a carriage; no matter in what way he employs the capital saved; he employs as much labour as formerly; or, what is the same thing, he purchases the fruits of capital and labour combined. He pays for commodities, formerly manufactured or obtained by human labour; because such a recompense was expected; such a return was looked for in the ordinary course of trading operations. So that the 3000*l.* saved by the machine, employs or pays for as much human labour as before, and consequently the aggregate demand for labour in the market is as great as it was previous to the introduction of the machine; always excepting that portion of the saving which the manufacturer, from some peculiar whim or fancy of his own, chooses to throw into the sea, or bury under the earth.

There is another mode deserving of notice, in which the money saved may probably be used. It may be placed in a banker's hands, or in the funds. The banker receives the money for the purpose of using it in his business. He would not be at the trouble and risk of receiving it unless he could use it profitably. The discounts, the additional accommodation he is thus enabled to afford manufacturers, merchants, farmers, &c., enables them to employ more labour. As to placing money in the funds, that may be said to be nothing more than a transfer of means from one who wishes to keep his money idle, to another who wishes to employ it actively.

It is true that the consumption of some individuals and of some classes is less beneficial than that of others. But in the present case the probabilities on the whole are equal. The sum of 3000*l.* is as likely to be employed beneficially in the hands of A as of B. Therefore, on these considerations, I contend I am justified in coming to the conclusion, that the introduction of a machine, attended with a saving to the manufacturer, and dismissal of some of his labourers, does not, *in the aggregate*, supersede human labour; does not diminish the demand for labour, or the amount of wages.

Let us extend this case to the whole trade, and view it in another light, by tracing the further effects of the introduction of machinery.

We will suppose that the commodity, whatever it may be, has been doubled in quantity, and reduced one-half in price. We will suppose the consumers to have paid two millions of pounds annually for the article or articles. Now they have to pay only one-half; having, of course, one million in their possession, to be disposed of in whatever way they think most conducive to their welfare. That this is a benefit to the consumer; that it is an increase of the national wealth, will not be denied; therefore the only question is, how does it affect the working classes as a body? They, of course, partake of the benefits in their character as consumers; and this is a most important consideration. As workmen, there is an additional demand created for their labour to the amount of the capital let loose, which must and will be employed, and can only be employed in paying for labour in some shape or other. It is capital that employs human labour. It is the relative amount of capital and labour in the market that determines the high or low rate of wages. Here, then, "is the one thing needful" for the working classes; an increase of capital, which must necessarily be followed by a higher rate of wages, and consequent increase of their means of subsistence—of their comforts aud independence.

When we consider the vast increase of machinery, the multiplication of cases similar to that which I have endeavoured to illustrate, since the first invention of Arkwright, we cease to wonder at the almost magical alterations that have taken place within a short space of time. Not many years ago Liverpool was a fishing town, and Manchester a country village. Silk was formerly sold for its weight in gold; and cotton could be purchased by the rich only. Now the wife or daughter of a mechanic is better provided with cotton than a lady was a hundred years ago. Rye, and other inferior breads, are now almost universally forsaken for wheaten bread. The cotton

manufactures employed in 1760 about 50,000 persons; now the same manufacture employs about one million and a half. The number of cattle has kept pace with the relative increase of the inhabitants, while the weight has doubled.

The whole of your Correspondent's objections against machinery seem to me to be concentred in two propositions.

1st. The introduction of machinery into a trade injures the workmen in that trade.

2nd. There are low wages, and consequently misery and poverty among the working classes.

And from these two propositions, separately or conjointly, he infers that "machinery is more prejudicial than otherwise to the labouring classes."

With regard to the first proposition, no one ever denied that the introduction of machinery injured individuals,—injured particular trades; but until the facts and arguments stated above are clearly and satisfactorily replied to, I must still remain of the opinion founded, as I conceive, upon the most conclusive statements and reasoning; that this partial evil is attended with "universal good;" and that, to the working classes, in the aggregate, most particularly.

As to the second proposition, that misery and poverty exist among the working classes,—call upon the enemies of machinery to prove that low wages exist *because of*,—and not in spite of—machinery. Compare the number of hand-loom weavers and others, who have been injured, with those who have been benefited by machinery; and the injured will be seen to be exceptions to the rule, composing a small portion only of the whole body of the working classes. What would be the condition of England now, with the amount of her population doubled, were the quantity of machinery reduced to what it was seventy years ago? The condition of Ireland, without machinery, without manufacture, comparatively speaking, is an answer to the question. A considerable portion of the population would be without labour, without wages; subsisting by the charity of their fellow-countrymen, and that on the worst description of food which can keep soul and body together. While the other more fortunate portion of the working classes would be obtaining, as the highest rate of wages, six or seven shillings a week, instead of that being as now—in consequence of machinery—the lowest rate of wages.

I have intruded at too great length already upon your columns, but I cannot lay down my pen without expressing a feeling, which, though it does not bear directly on the question, is yet intimately connected with it; viz., that it is the bounden duty of the legislature not only to alleviate, but to remove, the evils suffered by any portion of the community, for the sake of the public and general benefit.

I am, Sir, your obedient servant,
J. B.

## TO PRESERVE PROPERTY FROM FIRE.

*To the Editor of the Penny Mechanic.*

The simplest mode by which we can demonstrate the practicability of saving valuable property from fire will prove the most instructive, and bear with it a convincing proof that a right application of useful common inventions will often supply the place of more costly apparatus; and, in effect, prove safer and more desirable.

Take, for instance, a well-soldered tin, in any shape, say one foot square; at the distance of half an inch from the bottom, inside, place a few small bars, or strong wires, parallel to the bottom. Next, have another tin, nine inches square, with as large a circle in the top as possible. Let that part which is joined to the top be a female screw, and let the top screw into it. Having placed your valuable property in the small case, and secured the cover, place it inside the large case. Next, if you fill the large case with water, and let the water overflow the smaller case, is it not evident that the only effect a powerful fire will have on these cases is that of making the water boil, without, in the slightest degree, injuring the internal case and its contents; but, if the contents of the inner case were placed in an iron safe, the safe would get red hot, and its contents would be consumed.

On the principle described (which I believe is new) all combustible materials, spirits of wine, of turpentine, and even gunpowder, can be secured

against fire. Should the contents of any cask or case be likely to generate steam, and burst the cask, this effect can be guarded against by having small syphon-like pipes, rising a few inches higher than the water which surrounds the internal cask; and the steam generated will, if considerable, help to extinguish the fire.

On this principle, buildings that are sustained by cast-iron pillars may be constantly supplied with water, that, in case of large fires, will generate steam, which probably will assist in keeping the fire under. But to a certainty, the quantity of water contained in the pillars can be instantly got at, and the water will preserve the pillars from the effects of the fire. Under good regulations, in nine cases out of ten, the fires will be extinguished before the nearest engines arrive.

To preserve gunpowder under water, and thus prevent the dreadful evils that result from its explosion, as lately was the case in Limerick, is also a task easy to be performed. Let the powder be secured in tin cases, or small casks, either in cartridges or loose; let one end of the case or cask have a circular opening in it, and let the inside of this circle be a female screw. Let the top that is to fit in it be a male screw, that will not admit the water. When the top will be screwed home, by placing a weight on the case or cask it can be kept under water in perfect safety. This method is applicable to all powder manufactories, to all magazines and warehouses.

Should it be difficult at any time to prevent the leakage of the tin cases or casks that contain powder, &c., a coat of the solution of Indian rubber can be laid on, over the outside of the cask or case, and this will preserve the whole uninjured even for years.

In like manner, tea, sugar, ships' bread, and all manner of ships stores, together with the general cargoes of ships, can be secured against salt water.

M. Rough.

## WINDOW CLEANING ACCIDENTS.

If there are any accidents that deserve to be particularly designated by a name, they are those occasioned by the dangerous practice of suffering servants (generally female) to clean the outsides of the windows of gentlemen's houses. Notwithstanding the many dreadful accidents that this practice has occasioned, and the number of lives that have been lost from persisting in it, there appears to be very little desire to remedy the evil. After a housemaid has been impailed upon the railings, in front of a house, in consequence of having fallen out of a window she was cleaning, two or three stories high, we do not, perhaps, see servants, in the same street, exposing themselves to a similar danger for some short time; but after a while the accident is forgotten, and things go on much the same as usual. This is the necessary consequence of the present inconvenient way in which the windows of houses are constructed, and of the parsimony of the master or mistress of the house, who will not afford the money to pay a glazier for cleaning the windows in a proper manner.

The best remedy for this would undoubtedly be the construction of windows in a different mode to the present. A *Correspondent* (J. W. Ritchie) who has written to us on the subject, suggests that windows, instead of being made to open upwards, might slide into recesses formed on the two sides of the window-frame; the window being in two portions, similar to those which open on the lawn in gentlemen's country houses, only not hanging on hinges. Mr. Ritchie thinks this plan preferable to having the windows on hinges, which, indeed, would not at all remedy the evil complained of. But if one half of the window could be brought into the middle of the frame, while the other half remained in the recess, a person could get at the window from either the right or left hand of it, and the window could then easily be cleaned.

The following description of a contrivance for expeditiously detaching the lines of window-sashes is, however perhaps better calculated to answer the end in view, the plan being very simple and not attended with much expense.

*To the Editor of the Penny Mechanic.*

*(See Engraving front page.)*

Sir,—An invention, under patent, has lately been obtained, by which the lines

of window-sashes may be easily detached, for safety and convenience of cleaning. The expense of this invention is, perhaps, more than many persons would like to incur, as patentees usually employ their own workmen. I herewith, therefore, send you the diagram of a contrivance for the same purpuse, which can readily be attached to any sash, and I think will be found fully to answer the intention. Fig. 1. represents a piece of plate iron or brass, having holes drilled through as marked; the upper two to receive the wire staple, fig. 4, which must be riveted at the back, and through which the sash-line is to pass and be secured by the knot, fig. 5; the two holes near the bottom are to receive the ends of a piece of wire, when the sides of the iron plate are bent up to resemble fig. 2, and riveted. Over this piece of wire is an horizontal hole, about three-eighths in length, and only wide enough to admit the head of a screw hook, fig. 3, which is to be screwed into the sash, for the purpose of working and detaching. I think the diagram is the full size of the apparatus. If the box No. 2 was made in cast brass the expense would not exceed one shilling per sash. The hook, No. 6, I find however better adapted, both as regards safety and pecuniary views. The hook may be differently constructed, by a strip of iron bent to the form of No. 6, with a countersunk hole at each end to fit it on the sash with two common screws.

I am yours respectfully,
W. Clements.

## MECHANICS' LIBRARY.

*An address on the necessity of an extension of Moral and Political Instruction amongst the Working Classes.* By Rowland Detrosier. Cleave.

No book that we have hitherto noticed in this work better deserves a place in every mechanic's library than the above Address by Detrosier. A working man himself, he knew the evils and the misery that his class of society is exposed to; and as a man of intelligence, he has, in the tract before us, pointed out how the one may be avoided, and the other remedied. The plan is to improve the moral and political education of the working classes; and he advances the important truth which cannot be controverted, that *political melioration is the resulting consequence of moral progression.* There can be no doubt but that the degration and privations so often endured by the less wealthy classes of society, are the result of their ignorance. Yet how is this to be remedied? "Are there not thousands in this enlightened country whose circumstances bequeath to them little beside rising to labour and lying down to rest? Are there not thousands in this humane country, with whom labour commences almost before infancy has passed; thousands, the whole of whose education presents to them scarcely any thing more edifying than the examples of ignorance and brutality? Where is the individual bold enough to say no? They have, however, one redeeming virtue—industry! matchless industry!—to develop which no pains are spared, no means left untried, that avarice can dictate, or poverty oblige its victims to submit to. They are, consequently, in the generality of cases, considerably advanced in their knowledge of the mechanical arts; and beyond this, it is still presumed by some, the education of poverty ought not to extend." This opinion, however, is giving way to the liberality of the age. People begin to perceive the evils such opinions have generated. The case is eloquently stated by Detrosier in the following passage: He says, "*Science creates wealth; but it is morality that perfects man;* and the greatness, the prosperity, the happiness of a nation, demand the inseparable union of both. Were some catastrophe of nature instantly to destroy the records of human intelligence at present existing in this country; to sweep away, in an instant, all those things on the existence and possession of which the comforts of life in the different grades of society depend; to strip the land of all those witnesses of existing and past intelligence by which it is at present ornamented; and, sparing the population, to leave them the alternative of remaining destitute or constructing for themselves the requisites and comforts of life; who can doubt, for a moment, our physical power, or mechanical capacity, to extricate ourselves even from so forlorn a situation?

But let us ask the important question—are we as powerful in moral excellence as we are in mechanical skill? Were some political catastrophe to leave every man to be governed solely by the degree of knowledge which he, individually, might possess, what would be the scene presented to the eye of the spectator? What would be the moral consequence? What proportion of our population would be disposed to fulfil their moral engagements? What proportion would have principle enough to be a law unto themselves? Every one must feel the importance of these questions; the answer to which, were it possible to give it, would decide our claim to the character of a civilized nation, and show the amount of our moral excellence. A nation is civilized or savage, not in proportion to the morality or intelligence of the few, but of the many; for as the author of the Wealth of Nations has well remarked:—'Though a few individuals may possess great abilities, all the nobler parts of the human character may be obliterated and extinguished in the great body of the people.'" Our limits, we regret, will not allow us to do justice to this eloquent and powerful appeal to the intellect of the working classes—this heart-stirring call to "arise! or be for ever fallen." We can only say, we think so highly of it, that we hope every working man in the three kingdoms, who can read, will lay out *threepence* for a copy; and those who cannot read should purchase it, that those who can may impart to them the important truths with which this Address abounds.

## MISCELLANIES.

*Importance of practical Knowledge.*—It is a fact that some curious arts cannot be transported but by the workman himself. Most men will learn better by seeing the operation than by reading or any other method. This is illustrated in the following statement of a brass trinket maker of Birmingham, and is in substance as follows:—"Eighteen years ago, on my first journey to London, a respectable man asked me if I could supply him with doll's eyes; and I was foolish enough to feel half offended; I thought it beneath my dignity to make doll's eyes. He took me into a large room, and from the immense number of legs, arms, and trunks, I was convinced he wanted a great quantity of eyes. He gave me an order amounting to upwards of 500l. On my return, although I had some of the very best workmen in the glass toy line, yet they shook their heads, said they had seen the article before, but could not make it. I offered them great inducements to try their best, and after wasting much time the project was abandoned. Within a few months, however, I turned my attention again to the doll's eyes, determined to make them, if possible. After a while I met, by accident, a poor fellow in poverty from drinking, and dying of a consumption. I showed him ten sovereigns; he said he would instruct me in the process. He could not bear the smell of his own lamp, and though I was well acquainted with such work, I felt that it could not be done from his description. He took me into his garret, and before I had seen him make three I felt competent to make a gross; and the difference between his mode and that of my workmen was so trifling that I was astonished."

*Greenwich Railway.*—The number of passengers from Sunday, 5th March, inst. to Friday, the 9th, was 26,923. Money received 730*l.* 19*s.* The total number of passengers since the opening has been 239,354.

## INSTITUTIONS.

*London Mechanics' Institution.*—The usual quarterly meeting of this Institution was held on Wednesday evening, the 1st inst., when the Committee presented their Report, from which it appeared that the increased number of members had enabled the Committee to make several payments that, otherwise, they could not have done. The receipts of the quarter amounted to 546l. 18s. 1d., the expenses to 417l. 11s. The building debt had been reduced by the payment of 50l., and 109l. 7s. 1d. remained in the hands of the bankers. There were some accounts outstanding. Amongst the receipts of the quarter was 10l. 4s.

for single lecture tickets; this may, perhaps, account for the circumstance that only three ladies' tickets had been sold during the quarter. It also appeared from the Report, that considerable additions have been made to the library, 63 vols. of the "Public Records" having been presented by the Commissioners; and several other valuable books, by their authors, or by members of the Institution. The number of new members who had been elected was 331; the total number belonging to the Institution 1241. The report of the condition of the classes was very satisfactory. A class for the study of the Latin language was about being formed under the superintendence of Dr. Black. The books required by those members who attend it will not cost more than 5s. per member; but Dr. Black would not commence until he had obtained the names of 100 members willing to join the class. A short-hand class had also lately been commenced by Mr. H. Gregory, and met on Saturday evenings.

After the report of the Committee had been read and received, a motion for allowing the members of the Institution to attend the meetings of the Committee, without it being necessary to obtain their permission, was discussed, and the meeting afterwards adjourned till the next evening. The first motion having been put to the vote and negatived, one of a modified character was agreed to. Votes of thanks were then given to the different persons who had benefited the Institution, and the meeting adjourned.

*Colebrooke Literary Institution.*—The Rev. Robert Simson, M.A., Master of Colebrooke House Academy, well known as a lecturer upon education, and author of several works upon that important subject, on the 6th inst. delivered a lecture on Physical Geography, introductory to a course of twelve lectures on that department of science. The lecturer began with mentioning the importance of the study of geography, the more especially as we possess dominions in almost every latitude and every clime; and from the enterprising spirit of the British nation, there is not a corner of the world where some of her sons are not to be found. In a religious and moral point of view, the study of physical geography was observed also to be of paramount importance, because the physical condition of mankind reacts so powerfully on the moral, that the state of the former must be ascertained before the wants of the other can be supplied, or its deformities eradicated. From the excellence of the introductory lecture, the reputation of the lecturer, and the low price of admission (only 6*d.* each lecture, or 5*s.* for the twelve) we anticipate that many persons will be induced to attend.

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### LECTURES DURING THE WEEK.

*London Institution*, Finsbury Circus.—Monday, March 20, at seven, C. C. Clark, esq., on early British Poetry.—Thursday, March 23, H. J. Gauntlett, esq., on Ecclesiastical Music.

*London Mechanics' Institution*, Southampton-buildings, Chancery-lane.—Wednesday, March 22, at half-past eight, Dr. Grant, on the Molluscous Classes of Animals.—Friday, 24, Institution closed.

*Aldersgate-street Institution*—Wednesday, March 22, at eight, H. Goadly, esq., on the Anatomy of Insects, illustrated by the oxyhydrogen microscope.

*Western Literary and Scientific Institution*, 47, Leicester-square.—Thursday, March 23, at half-past eight, Dr. Lardner, on the Steam-engine.

*Eastern Athenæum*, Stepney Square.—Wednesday, March 22, at eight, W. Lukeing, esq., on Chemistry.

*Islington Literary and Scientific Society.*—Thursday, March 23, at eight, Mr. T Cromwell, on the Archeology of the British Islands.

*Poplar Institution*, East India Road.—Tuesday March 21, at eight, B. R. Haydon, esq., on Painting, with illustrations.

*Westminster Mechanics' Institution*, Grosvenor St., Millbank Row. — Wednesday, March 22, at eight, S. Logan, esq., on Phrenology.

*Kentish Town Mechanics' Institution.*—Monday, March 21, J. Smith, esq., on the Essentials of General Happiness.

*Bermondsey Mutual Instruction Society.*—Monday, March 20, at quarter past eight, Mr. L. Rickard, on the Steam Engine.

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### TO CORRESPONDENTS.

We should feel obliged if our Correspondents, when describing machinery, would write shorter sentences. This would prevent ambiguity. Many of our friends use so many *pronouns* in their favour that we cannot ascertain the *nouns* to which these pronouns refer.

"W. D." and "Snully Gong," on Land Skates, next week.

We shall notice the "Engineers' and Mechanics' Encyclopœdia" the very first opportunity.

"N. D." The Society of Arts will *not* give a prize for an invention if it is patented.

"Question" wishes to know "how it is that clay, unlike other bodies, contracts instead of expanding by heat?"

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# THE PENNY MECHANIC.

A MAGAZINE OF ARTS AND SCIENCES.

No. XXII.] SATURDAY, MARCH 25, 1837. Vol. I.

## THE MECHANICAL POWERS.--NO. II.

FIG. I.

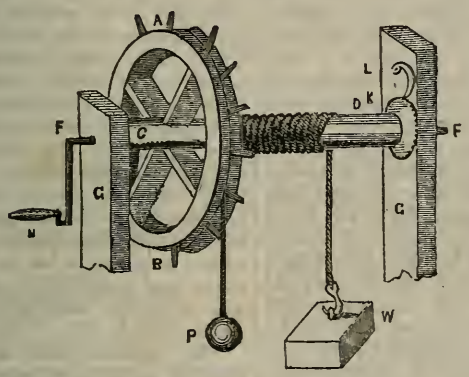



FIG. II.

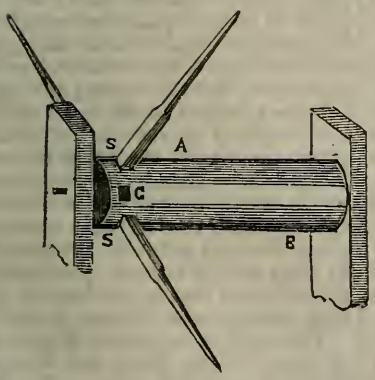
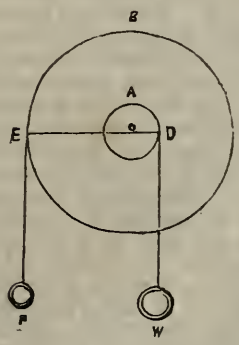



FIG. III.






Holloway Press: D. A. Doudney.

## THE MECHANICAL POWERS.

### NO. II.

### THE WHEEL AND AXLE.

THE *Wheel and Axle* (Fig. 1.) is the second mechanical power; A B represent the wheel, and C D the axle, at the extremities of which are two pivots F F, which with the whole may turn in the wooden blocks G G. In this machine an equilibrium takes place, when the circumference of the wheel is to the power, as the weight is to the circumference of the axle. The weight to be raised is attached to the end of the rope coiled round the axle as at W, and the power or exertion required to raise it, is applied at the handles fixed in the circumference of the wheel, or at the end of a cord passing round the circumference as at P. The power gained by this machine is in proportion as the circumference of the wheel is greater than that of the axle, if the circumference of the wheel be twelve feet, and that of the axle only one foot, the advantage obtained by it will be as twelve to one, or a weight of twelve pounds at W, will be balanced by a weight of only one pound at P, and the least additional force at P, will cause the weight at W to rise, and *vice versa.* When the wheel and axle is employed for the purpose of drawing water out of deep wells, the winch or handle H F is in general used instead of the great wheel A B, for the weight to be raised in this case is not very considerable, there being but seldom more than one bucket drawn up at a time. When great force is required in order to lift any very heavy weights, as in the operation of raising different ponderous bodies to the roofs of houses, &c.; this instrument is made with cogs fixed all round the circumference of the wheel, and which is turned by a winch attached to the axis of a small trundle-wheel which works in the cogs. In this kind of machine the racket wheel K, with the catch L, is a very necessary appendage, for should the workman through carelessness quit his hold, while in the act of raising any heavy weight, the catch would fall into the teeth of the racket wheel, and prevent the danger which would most probably occur by the body descending at random. Sometimes in the place of a wheel long levers as in fig. 2. are used, which are inserted at one end of the axle in the orifices S S, and which may also be shifted from one orifice to another according to their most convenient positions; in this machine the power is to the weight, as the circumference of the axle A B is to the circumference of the circle described by the extremities of the levers, but this holds good only on the condition that the power is applied in a direction perpendicular to the lever, or that it is a tangent to the circle described by the lever. The power of this instrument may be increased either by lengthening the levers, or diminishing the thickness of the axle. The *capstan* which is a verticle cylinder, moveable on an axle, is turned in the same manner as the machine just mentioned, with levers, which are pushed round by the exertion of the men using them. In the wheel and axle as in all other machines, there must be an allowance made for the friction, which, although perhaps is not very considerable, must, in practice be taken into consideration. And it must likewise be taken as a fundamental law, that what is gained in power is lost in time, for the space, and consequently the time lost, will be in the same proportion as the power gained.

The machine used in copper-plate printing called a *rolling-press*, consists of two cylinders whose axles are fixed parallel to each other in the same blocks or frame, one of which is beneath and the other above a smooth horizontal plank placed between them; on the plank is laid the plate from which the impression is required to be taken, and also the paper which is to receive the impression, then by turning the upper cylinder by means of the levers (four in number) fixed on that part of the axle outside the block, the plank is passed between the cylinders, and the impression is taken; now in this machine the upper cylinder with the levers represents a sort of wheel and axle, but instead of its being used for drawing up any weight, it is used as a kind of gradual and uniform pressure upon the plate beneath it.

The *Jack*, an instrument of great importance in lifting timber and other materials, is composed of a straight iron bar with cogs on one side of it, moving perpendicularly in a wooden block or case, and is elevated or depressed by a

small toothed wheel, which being turned with a handle, works in the cogs. This is also referrible to the wheel and axle, for the power is applied at the handle, which by its circular motion describes the wheel, and the small toothed wheel which represents the axle, by working in the cogs of the iron bar, raises the weight required.

The wheel and axle may be considered as a *lever* of the *first* kind, so constructed as to have a continual motion on its fulcrum or centre, in consequence of which it has been termed the perpetual lever. Let A (fig. 3.) represent the axle and B the wheel, both of which turn on the same fulcrum C; now if the weight W act at that part of the axle at D, six inches from the fulcrum C, and the power act at that part of the wheel at E, two feet from the fulcrum C, it is evident that the machine gains power in the proportion of four to one, because the radius of the wheel is four times as great as that of the axle. To this mechanical power may be referred the various cranes, &c., almost continually under our notice.

## COTTON MANUFACTURE.

England may be said to have been a manufacturing country for five hundred years, from the time, namely, when the clothiers of Flanders came over in great numbers and settled themselves in different parts of the kingdom, on the marriage of our Edward III. to Philippa of Hainault. The manufacture of cotton cloth, however, was not introduced among us till about the middle of the seventeenth century, and made no extraordinary progress for a hundred years afterwards. As an evidence of the comparatively slight degree of interest which it excited, and of the little ingenuity which was consequently exerted in its improvement, it may be stated that the valuable invention of the fly-shuttle, which was introduced into the woollen manufacture about the year 1738, was not employed in the weaving of cotton till more than twenty years afterwards; up to which period, whenever the web was more than three feet wide, two men were constantly stationed at the loom in which it was wrought, the one to throw the shuttle from right to left, and the other to throw it back from left to right. It was not till the year 1769 that an attempt was made upon any considerable scale to spin cotton thread by machinery; for, whatever may have been done before this time by individuals of mechanical ingenuity in inventing contrivances for that purpose, it is certain that the invaluable improvement in question was really introduced into the manufacture by Arkwright when he took out his patent and built his first mill.

The revolution, therefore, we may almost say, in the whole aspect and character of our manufacturing and commercial interests, which has hence arisen, is the work of only the last sixty years. About the beginning of the last century, the quantity of cotton wool annually imported into Great Britain did not amount to 1,200,000 lbs.; and by the year 1720 it had not increased to much beyond 2,000,000 lbs. There are no returns from 1720 to 1771; but the importation had probably gone on increasing during that interval, although at a slow rate. Nor did it make a very rapid progress even for several years after spinning by machinery was introduced, having from 1771 to 1775 averaged only 4,764,589 lbs., and for the next five years only 6,706,013 lbs. In 1784, the year immediately preceding the final repeal of Arkwright's patent, it amounted to 11,482,083 lbs. That event gave a great impulse to the manufacture, the average importation for the next five years having grown to 25,443,270 lbs. annually. In 1799 it had risen to 43,379,278 lbs., and in 1800, to 56,010,732 lbs. In 1817 it was 124,912,968 lbs., and in 1825 it actually amounted to the immense quantity of 228,005,291 lbs. The average importation of cotton wool into Great Britain may now be stated as considerably exceeding 200 millions of pounds per annum, or as amounting to fully a hundred times what it was a century ago, and to more than fifty times what it was when Arkwright began to spin.

The whole of this raw material, with the exception of about ten millions of pounds which are used in an unmanufactured state, and from ten to twenty millions which are annually exported, is spun into thread, and mostly wrought into cloth, in this country. The Rev. Dr. Cartwright invented his power-loom in 1784; but it is only since the com-

mencement of the present century that weaving by machinery has become general. Steam was first applied as the moving power for the spinning machinery in 1785; in which year Messrs. Boulton and Watt erected one of their rotative engines for a factory belonging to the Messrs. Robinsons at Papplewick, in Nottinghamshire. In the present day the cotton is carded, spun, and woven into cloth in the same manufactory; these different operations being performed by machinery, the several parts of which are all set in motion by a single steam-engine.

In 1787 the number of spinning factories in the county of Lancaster amounted only to 42, of comparatively inconsiderable magnitude; in August 1825, there were, according to Mr. Baines, no fewer than 104 such factories in Manchester alone, which were worked by 110 steam-engines, of the aggregate power of 3,598 horses. The number of steam-looms now at work in the kingdom is calculated at 45,000, of which about 8,000 are in Scotland, and above 20,000 in Manchester. In 1824, it has been stated that the number of spindles constantly in motion was about six millions, and the power by which they were moved equal to that of 10,572 horses. In another statement, however, drawn up by Mr. Kennedy, it is calculated that in 1817 (when the importation of cotton wool was not nearly so great as in 1824) the number of spindles was 6,645,833, and the moving power equal to that of 20,768 horses. Some idea may be formed of the growth of this manufacture since the year 1769, by contrasting the astonishing number of threads which it would thus appear are spun every day now, with the 50,000 which were all that were produced then.

The produce of all this machinery is, as may be supposed, immense. "In the present improved state of this (the weaving) process," says the writer of an article in the Supplement of the Encyclopædia Britannica, "one person, generally a girl, attends to two looms, the weekly produce of which is from seven to nine pieces of cloth, of seven-eighths wide, and twenty-eight yards long." "A single factory in Manchester," says Mr. Guest, writing in 1828, "and that not of first-rate magnitude, receives the raw cotton, and turns out a web of cloth, varying in width from three quarters of a yard to a yard and a quarter, of forty miles in length every week." In 1750, it has been calculated that the whole amount of the cotton manufacture of the kingdom did not exceed the annual value of 200,000*l.*; it is now considered on good grounds, to amount to fully thirty-six millions of pounds sterling per annum. Sir Richard Arkwright states, in his Case published in 1781, that the capital then invested in buildings and machinery by those engaged in this trade, amounted to 200,000*l.*; it is calculated to amount now, in Lancashire alone, which possesses about four-fifths of the trade, to 8,000,000*l.* In the year ending on the 1st of May 1818, 105 millions of yards of cotton cloth of all sorts were manufactured in Glasgow and the neighbourhood, of which the value was about 5,200,000*l.* Of this about one half was exported. The value of the cotton cloths, twist, and yarn, exported from Great Britain for some years past, has been on an average about 16,000,000*l.*, leaving of course about 20,000 000*l.* worth for home consumption. The export trade in cotton is now fully three times that in woollens, the manufacture of which used to be the great staple of the kingdom.

The extraordinary perfection to which every part of the cotton manufacture has now been carried is another result for which we are entirely indebted to the introduction of machinery. Especially since the invention of the mule, a compound of the jenny and the water-frame, about the year 1790, the muslins manufactured in England have been every year attaining a greater fineness of fabric, and are now rapidly approaching to a rivalry even in this respect with the most exquisite productions of the East. As an illustration of the state of advancement to which the spinning process has been brought, it may be mentioned, that "Mr John Pollard, of Manchester, spun, in 1792, on the mule, no fewer than 278 hanks of yarn, forming a thread of 233,520 yards, or upwards of 132 miles in length, from a single pound of raw cotton." The diminution of the price of the manufactured article which has been produced by the successive improvements in the cotton machinery is equally extraordinary. Yarn of what

is called No. 100, which even in 1786, after its price had been greatly reduced by the cancelling of Arkwright's patent, sold for thirty-eight shillings, has fallen in price every year since that time, and is now to be had for three or four shillings. The raw material is now indeed brought from India, and manufactured into cloths in England, which, after being re-exported to that country, are actually sold there cheaper than the produce of the native looms. There can hardly be a more striking proof than this of the triumph of machinery.

Finally, it has been calculated that while the number of persons employed in the cotton manufacture in 1767, did not probably amount to 30,000, the number of those now engaged in its different departments can hardly be less than a million. Yet, "in some branches of the business," it has been stated, "the spinning in particular, such is the economy of labour introduced by the use of machinery, that one man and four children will spin as much yarn as was spun by six hundred women and girls fifty years ago."—*Library of Entertaining Knowledge.*

## WOODEN BELLOWS.

It is somewhat singular that the inventors of most of our household instruments—those we use every day, and which add so materially to our enjoyments without our ever thinking of them—it is, we say, somewhat singular that in almost every case their inventors are unknown. The men who first taught others how to obtain fire, certainly effected as much, if not more, for mankind than Watt by his invention, or Arkwright, or anybody else, by his. Yet even fable is silent in the former case, while Fame with her thousand trumpets is sounding forth the certainly well-earned praises of the latter. Our readers must not suppose from this that we are going to introduce to their notice the name of any long-forgotten benefactor of his fellow-men; we should feel very happy in doing so, but at present we are only going to describe a very ingenious piece of machinery, the author of which is forgotten, but who certainly deserved to be remembered, if it were only for having done mankind what little service lay in his power. The machine we allude to is the wooden bellows.

After the discovery of fire, the first instrument employed to blow it, and strengthen it, would undoubtedly be a hollow reed, until the art was found out of forming a stick into a pipe by boring it. Our common bellows, which consist of two boards joined together by a piece of leather, and which probably are an imitation of the lungs of animals, appear to have been early known to the Greeks. Strabo states, that the Scythian philosopher, Anacharsis, who lived in the time of Solon, invented the bellows, and also the potter's wheel, and the anchor. Whether the two latter originated with him is doubtful, but it is interesting to think that the invention of an instrument so humble as a pair of bellows can be traced back for so long a period.

The wooden bellows were invented in Germany, but by whom is unknown. They are mentioned in a catalogue of various machines in 1550, and are stated to be capable of producing a strong blast for melting metals, and could also be used for organs.

The whole machine, as described in the History of Inventions, consists of two boxes placed the one upon the other, the uppermost of which can be moved up and down upon the lower one, in the same manner as the lid of a snuff box, which has a hinge, and moves up and down when it is opened and shut. The sides of the uppermost box are so broad as to contain the lower one between them, when it is raised to its utmost extent. Both boxes are bound together where the pipe is through which the air is forced, by a strong iron bolt. It may be readily comprehended that when both boxes fit each other exactly, and the upper one is raised over the under one, which is in a state of rest, the space contained by both will be increased; and consequently more air will rush in through a valve placed in the bottom of the lower one; when the upper box is forced down, this air will of course be expelled through the pipe. The only difficulty is to prevent the air which forces its way in, from escaping anywhere else than through the pipe;

for it is not to be expected that the boxes will fit each other so closely as to prevent entirely the air from making its way between them. This difficulty, however, is obviated by the following simple and ingenious method. On the inner side of the uppermost box there are placed moveable slips of wood, which by means of metal springs are pressed close to the sides of the other box, and fill up the space between them. As these long slips might not be sufficiently pliable to suffer themselves to be pressed close enough, and as, though planed perfectly straight at first, they would in time become warped in various directions, incisions are made in them across their whole length, at the distance of from fifteen to eighteen inches from each other, so as to leave only a small space in their thickness, by which means they acquire sufficient pliability to be everywhere pressed close enough to the sides.

This is a description of the method by which these bellows were manufactured some twenty or thirty years ago: several improvements will, however, no doubt suggest themselves to the mind of the ingenious mechanic. The advantages of these bellows are said to be very great. When made of clean fir wood, without knots, they will last, it is said, thirty or forty years, and even longer, though continually kept in action forty-six or forty-eight weeks every year. The effect produced by them is stronger, as well as more uniform, than by the ordinary bellows, and the blast of air can be moderated according to circumstances. They are worked also with great facility. The slips of wood on their sides are apt to become damaged, but they can easily be repaired. Every three or four months, however, the outer sides only of the inner box, and the bolt which keeps the boxes together, must be smeared with oil.

Grignon, when speaking of the above invention, and noticing its German origin, says, "Germany is the country of machines. In general the Germans lessen manual labour considerably by machines adapted to every kind of movement; not that we are destitute of able mechanics; we have the talent of bringing to perfection the machines invented by our neighbours." When a somewhat similar observation was made with reference to gentlemen's "ruffels," it was observed, that though "our neighbours" might have invented this once much esteemed and fashionable portion of dress, yet it was the Englishman who had the "talent of bringing it to perfection," by adding a shirt to it. It will be found pretty nearly the same with most other inventions. There are few, or no countries in the world at the present time, that can boast of the possession of so much mechanical skill as England; and Grignon's remarks, whether relating to a pair of bellows, or to any thing else, will therefore now be quite inapplicable.

## LAND SKATES.

*To the Editor of the Penny Mechanic.*

Sir,—In perusing in your Magazine an article headed "Land Skates," it struck me that the spindle of the wheels could not be made to support a man's weight. I do not conceive where you could put the bearings for the spindles; they would either bend or break; besides you could not get the wheels strong enough for that purpose on such a small compass as they are proposed to be on. If you think these hurried remarks worthy of a place in your useful work, an insertion will oblige

Your most respectful
W. D.

## LAND SKATES.

*To the Editor of the Penny Mechanic.*

Sir,—I observe in the last number but one, of your Magazine, a correspondent who signs himself "H. Baker," suggests a plan for skating on dry ground by means of an article which he calls Land Skates, and at the end of his communication he begs one of your kind correspondents to acquaint him whether he is right or wrong in his idea. I therefore, (being naturally of a *kind* disposition), beg to acquaint the said gentleman, that he is most decidedly wrong; though his plan might be improved upon so as to render it efficient. In the way that he proposes there would be too much *friction*, and though he might manage to

get on a little way, yet to keep up would be utterly impossible; but, if the middle wheel of both skates was made a little larger than the rest, I have no doubt but what it might answer, for in that case, though the other wheels would be of use in the first starting, yet when at full speed, you would be entirely skating upon the larger wheel—indeed, I doubt whether in the way that Mr. Baker proposes he would be able to turn, whereas by the simple addition that I propose, he might do so with perfect ease.

Yours Obediently,
SNULLY GONG.

*** WE think if our correspondents will test their theories by *experiment*, it will be found that travelling in the way they propose is more difficult than they imagine. We question whether there would be sufficient friction between the wheels and the earth to enable them to proceed at all, at any rate if the edge of the wheel is to be used in the same way that the edge of the skates is on the ice, for the purpose of propelling the body forwards, the land skates will not last many journeys.

## IMPROVED CONDITION OF THE WORKING CLASSES.

SIR,—If you intend that your Magazine should be of any use to the working classes, you should keep out of it, all doctrines of political economy, and more especially those of the Brougham, Martinieu, and Malthus school. You may depend upon it, Sir, that you may write on till doomsday, but you will never make the working classes believe, that they are so well off as they ought to be, or that they ought to be content with their present condition. Look, Sir, at the dreadful state of the Spitalfield's Weavers at the present time. Look at the dreadful state of hundreds of thousands of the working classes, in the manufacturing districts of this country. Why, Sir, their condition is such, that it is nothing but the "strong arm of the law," that keeps them from breaking out into open *rebellion*.

But, Sir, you must know all this, you must know that the present condition of the working classes, (generally speaking) is awful in the extreme. Then why seek to pervert the truth? Why seek to make the working man believe, that he ought to be content? Why seek to defile the pages of your (otherwise excellent) work, by such vile doctrines as those you have put forward, under the head, "*Improved* Condition of the Working Classes?"

Believe me, Sir, I thought much of your work, prior to the insertion of the extraneous matter I have referred to, but now I look at it with something like loathing. And, Sir, if you do not desist, I shall cease to be a subscriber, and I know very many that will do the same, therefore I hope you will explain yourself in your next Number.

I am, Sir,
Yours, &c.,
J. D. G.

P.S.—Depend upon it, Sir, that the time has gone by when the working classes of this country, are to be cajoled into a belief, that their present political condition, is what it ought to be.

*** WE publish this letter *verbatim* as we received it, for the purpose of showing, not only how much mistaken J. D. G. is respectiug the tendency of the article to which he refers, but also, that he is wrong in supposing that if it is admitted the working classes are better off now than they were a century or two ago, that therefore they should "be content with their present condition."

If our readers will do us the favour to refer to the articles on "the Improved Condition of the Working Classes," in Numbers 19 and 20, they will then be able to judge whether there is any thing in those papers calculated to excite the "*loathing*" of J. D. G., and whether we have perverted the truth, or inculcated vile doctrines. Without assenting to the doctrines of political economy propounded by "Brougham, Martineau, and Malthus, (which are not in *any way* introduced in the article), we cannot see why, without any reason assigned, we should be so strongly warned to keep them out of the Penny Mechanic. We address our readers as intelligent beings, who *reason* upon what they read. We do not suppose them such idiots as to assent to a proposition merely because they see it in print. We are sure they will form their judgment for themselves, and we should therefore hold ourselves guilty of a crime if we endeavour to smother an opinion *merely* because it happened to be opposed to our own. J. D. G. need not, however, be afraid that we shall introduce the subject into our pages. We have a better reason for refraining. We do not wish to make this work the vehicle for *any party;* much less a *political* one. Politics therefore we eschew.

Our correspondent appears to think the tendency of the article is bad, because it

endeavours to prove that the working classes are more comfortably situated now, as a body, than they have been heretofore. We stated facts. We did not manufacture them. They are a part of history, and the works from which they are taken, merely record what has happened. The conclusion we draw from these facts is, however, very different to that of J. D. G. It appears to us, that if the condition of the working classes has been progressively improving, there is no reason why it should not continue to do so. Why if they are better off now than they were fifty years ago, (we speak of the whole body) that they should not be still more improved, physically and mentally, fifty years hence, than they are at present. This is the just conclusion that should be drawn. If men were content to remain stationary instead of endeavouring to progress—to improve in knowledge and in virtue—there would be an end to all the hopes of those who look forward to the time

When man to man, o'er all the earth,
Shall brothers be and a' that.

Instead, therefore, of wishing any one to remain "content," in this sense of the word, we shall always do all we can to make him aspire to become a wiser and a better man, than he ever can be if he is content to remain ignorant of his duties and his rights.

*Steam Plough.*—The Highland and Agricultural Society of Scotland has offered the premium of 500*l.* for the first successful application of steam power to the cultivation of the soil. We presume from this that the steam plough invented and used in June, last year, by Mr. Heathcote, M.P. for Tiverton, has not proved successful.

*To preserve Boots and Shoes from Cracking.*—My boots being damp the other day, I placed them on the top of an iron stove, with the intention of their remaining a few seconds only. Being suddenly called away on other business, I forgot my boots. When I returned they were pretty well roasted. Being afraid they were spoiled, I applied lamp oil to the burnt part until it would receive no more. This was to keep them from cracking. Since that time they have been more impervious to moisture, very hard, and I have no doubt will wear the longer for it. I have been told by a first-rate bootmaker that linseed oil would have been better. This hint may be improved by others.

## INSTITUTIONS.

### LECTURES DURING THE WEEK.

*London Institution*, Finsbury Circus.—Monday, March 27, at 1 o'clock, afternoon, R. Bond, esq., on Physical Geography.—Thursday, March 30, at seven, H. J. Gauntlett, esq., on Ecclesiastical Music.

*London Mechanics' Institution*, Southampton-buildings, Chancery-lane.—Wednesday, March 29, at half-past eight, Dr. Grant, on the Molluscous Classes of Animals.—Friday, 31, M. Foggo, on Taste in Literature and the Arts.

*Aldersgate-street Institution*—Wednesday, March 29, at eight, H. Goadly, esq., on the Anatomy of Insects, illustrated by the oxyhydrogen microscope.

*Western Literary and Scientific Institution*, 47, Leicester-square.—Thursday, March 30, at half-past eight, Dr. Lardner, on the Steam-engine.

*Eastern Athenæum*, Stepney Square.—Wednesday, March 29, at eight, C. C. Clark, esq., on the old Ballads.

*Islington Literary and Scientific Society.*—Thursday, March 30, at eight, Mr. T. Cromwell, on the Archeology of the British Islands.

*Poplar Institution*, East India Road.—Tuesday, March 28, at eight, J. Howell, esq., on Astronomy.

*Kentish Town Mechanics' Institution.*—Tuesday, March 28, J. Smith, esq., on the Communication of truth.

*Bermondsey Mutual Instruction Society.*—Monday March 27, at eight, J. J. Hawkins, esq., on Popular Education.

### TO CORRESPONDENTS.

"Charles J—s." Both letters shall be attended to. The caution in the one first received it is not necessary to publish.

"A Reynolds." We cannot promise to insert his paper for some little time, but it shall not be forgotten.

"J. R. W." The same answer will apply to this correspondent.

"R. W." Shall be answered.

"O. P. Q." The Thames Tunnel has 4000 shareholders at £50 each. This sum has been paid upon each share, yet they can now be bought for £7 10s. each. We believe government has advanced £20,000 to complete the undertaking, and it now appears likely to be brought to a successful termination.

Received, letters on "the Results of Machinery," from "J. W. Ritchie."—"An admirer of Science, but an hater of exclusiveness," and "S."

"W. Wivell" shall hear from us by post.

We have not received the list yet from the "Tower Street Society."

In our notice to correspondents last week, the word "Favor," should have had "s" at the end of it, this will alter the sense a little.

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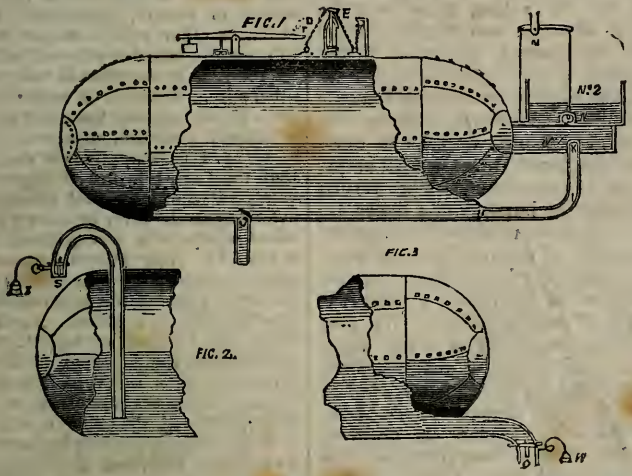
# THE PENNY MECHANIC.

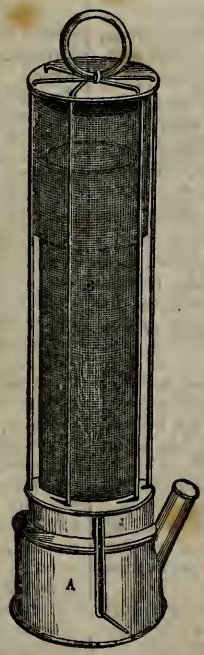
A MAGAZINE OF ARTS AND SCIENCES.

No. VII.] SATURDAY, DEC. 17, 1836. [Vol. I.

DOUGLAS'S STEAM BOILER.




THE DAVY LAMP.






Holloway Press: D. A. Doudney

## STEAM BOILERS.

The improvements made in the machinery of the steam engine by Watt were so complete, and so well adapted to effect all that could possibly be desired, that it has for a long time been the opinion of scientific men, that the boiler in which the steam is generated, is the only portion of the engine in which we may expect any material improvements to be effected. However superior the boilers at present used may be to those formerly employed, there is still ample room for improvement. The results which attend the bursting of a boiler are so terrific, that we need not be surprised at the number of patents that have been, and are continually being taken out, for the purpose of providing against the possibility of such accidents. We give this week an engraving of a very ingenious piece of apparatus that has been lately invented for this purpose, by Mr. Douglas, of Great Ormand-street, London. Most of our readers are probably aware, that all boilers are provided with what are termed safety valves. These open outwards, and are kept down, or loaded as it is termed, by a weight capable of resisting a certain pressure from the steam within: when this pressure is much increased, it of course counteracts the effect of the weight, and raises the valve, by which means the steam can escape without bursting the boiler. It happens sometimes, however, that the valve becomes fixed, or is prevented rising by some obstacle, in which case the steam will acquire so great an explosive force, that the boiler will burst. Mr. Douglas's invention, we think, is calculated to lessen, if not to remove the danger entirely. His description of it is as follows:—

Fig. 1, is the side elevation of a boiler in which it is intended to generate and employ low-pressure steam, with his improvements attached; part of this boiler is represented open or enclosed, in order that the improvements may be more distinctly exhibited by the drawing.

Fig. 2, is the end of a boiler in which it is intended to generate and employ steam of a high-pressure, with part of the improvements attached. And

Fig. 3, is also the end of a high-pressure steam-boiler, with that part of his improvements shown in fig. 2, attached to it. This last arrangement fig. 3, being merely exhibited here to show how the situation of the bell B, and the valve C, may be altered for purposes of convenience. The improvements may be said to consist of two distinct arrangements for insuring safety to boilers, generators, caldrons, stills, or other vessels subject to changes of pressure, whether external or internal, by increase or decrease of temperature or otherwise. When it is wished to guard such vessels against too great an increase of internal pressure, improvements shown at A, (fig. 1,) are applied in such manner that they shall insure the opening of a safety-valve of the usual description, by acting upon the lever or other part of the usual safety-valve arrangement shown at B (fig. 1). The Patentee constructs a small cylinder above the point A, or other convenient part of the said vessel, and fits into the cylinder a piston. As the piston rod C, (fig. 1,) rises or falls in the small cylinder by the increase or decrease of pressure within the vessel, it is made to operate upon the chains D, E, (fig. 1). Connected with the chain E, will be seen a small steelyard, spring balance, or other well-known indicator of pressure, G, suspended from the fixed bracket F. When the piston rod C, ascends this chain, E, is acted upon, and the index hand of the spring balance G, will (in this particular arrangement) be seen to have moved downwards. When the piston rod C descends, the pull upon the chain E, is lessened, and the index hand of the spring balance G, will (in this particular arrangement) be moved upwards. The chain D, is operated upon by the rise and fall of the piston rod C. One end of the chain D, is passed through a hole in the end of the safety-valve lever at T, in such manner that it shall have a little play without disturbing the safety-valve by every fluctuation and variation of pressure which may affect the piston rod C, and the indicator G. But if the pressure should continue to increase, and should the safety-valve at B, not blow open, the ascending motion of the piston rod C, will very soon cause the chain D, to pull upon the safety-valve lever and cause (or contribute to cause) the opening of the safety-valve. The improvements described above, or modifications of them, Mr. Douglas considers applicable as the means of greater safety, where the causes of boilers or other vessels bursting are such as are generally acknowledged. But as he has from long experience and observation been led to believe that some explosions are attributable to other causes, he has provided

for such peculiar causes by the apparatus shown on fig. 1, H, I, K, L, M, N, and O, for low-pressure boilers and other vessels. And by the apparatus shown on fig. 2, P, Q, or by the apparatus shown on fig. 3, R, S, for high-pressure boilers or other vessels. These latter cases of explosion he attributes to the water or other liquid being raised up from the bottom of the boiler, by the rapid formation of elastic vapour which cannot with sufficient rapidity pass up through to the surface of the liquid; such an elastic vapour being a bad conductor of heat becomes more highly charged with heat, and with the more power repels and drives upwards the liquid, forcing the steam off by the valve, and sometimes the water also. When in such cases the valve is shut, the deflected forces cause a showering of the upper and cooler liquid amongst the lower or hotter elastic vapour, by which this hotter elastic vapour is condensed or partially condensed, and the pressure is thus suddenly reduced below the pressure of the atmosphere. He therefore provides the low-pressure boiler with a supply of water ready to rush in below when this reduction of pressure takes place in the inside, as at fig. 1, and he provides the high-pressure boiler with a supply of atmospheric air to rush in as at figs. 2 and 3. In low-pressure boilers is used the arrangement of cisterns (fig. 1), when the internal pressure is too little, and a collapse likely to happen, the hanging valve K, will be pressed open by atmospheric pressure, and water from the cistern No. 1, will flow into the boiler along K, I, H. For keeping No. 1, well supplied with water, he uses the common float apparatus L, M, by which means water is permitted to flow down N, from No. 2, when required in No. 1. In some situations, and particularly in steam-boats, a mere pipe and valve O, from the bottom of the boiler into the water will answer the same purpose for either high or low-pressure, and may then be better than the cisterns No. 1 and No. 2. In high-pressure boilers the Patentee prefers using the arrangement of a pipe and valve with signal bell, shown in fig. 2, and air is pressed in through the valve Q, and through the pipe P, when necessary to prevent a collapse. The signal bell W, is intended to warn the engineer that such change has taken place. In some situations it is better for the air-pipe valve and bell to be arranged as on fig. 3, at R, S, X.

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## THE DAVY LAMP.

If we were requested to point out an example of what science has done for man, there is none to which we should refer with greater satisfaction than to the Safety Lamp, invented by Sir Humphrey Davy, for the purpose of preventing the explosion of inflammable gases in mines. This little instrument, of which an engraving is given in our front page, has, perhaps, been the means of saving more lives than any other whatever. Before it was introduced into our coal-mines there was no certain security for the miner against a frightful death, except he worked in the dark. As this however could not be done, explosions were constantly occurring, generally attended with the loss of many lives. These accidents at last took place so frequently, and, in consequence of its being impossible to work in the mines at all, except under peculiar circumstances, the value of mining property was becoming so much depreciated, that a number of gentlemen formed themselves into a society for the purpose of discovering, if possible, some means of remedying the evil. They applied to Sir Humphrey Davy, and he, after performing a variety of most ingenious experiments, produced the Safety Lamp. We must defer till a future Number a description of the beautiful specimen of inductive reasoning which the discovery of the Safety Lamp affords, and at present simply describe the lamp itself. It is indeed merely a common lamp, inclosed in a case of wire gauze, which possesses the property of preventing the passage of flame through it. Any one may prove this for himself, by holding a piece of wire gauze over the flame of a candle, when he will find that the flame does not pass through. In the bottom part of the lamp is contained the oil, which supplies the wick rising in the centre. In most lamps a small reflector is placed behind the wick, and in front of it a lens, for making the light more powerful. A piece of spongy platinum is placed in the wick, and when the flame of the lamp is extinguished by the foul air, this platinum keeps at a red heat, until the miner removes to a less dangerous spot, when the wick is ignited by it, without its being necessary to open the wire gauze. It will thus be seen that the whole merit of the lamp consists

in having this protection against the flame communicating with the inflammable gases outside, and in the use of the piece of platinum; yet this simple invention has, perhaps, effected more good than any other that was ever proposed.

## NATURAL PHENOMENA.

### FORMATION OF DEW.

The appearance of dew is familiar to every person, and is perhaps one of the most beautiful objects for contemplation in nature. In all ages it has been a subject for the poet as well as the naturalist, and few persons indeed can view the dew-drop on the grass, reflecting all the colours of the rainbow, or glittering on the delicate thread of the spider, without being struck by the beauty of its appearance, and wishing to know something of the cause that has produced it.

The importance of dew to the vegetable world, in particular, will perhaps be appreciated, when it is stated, that very many plants derive nearly the whole of their nourishment from the water deposited in this manner. Every plant, indeed, depends on it more or less; and in some countries, where rain very seldom occurs, the inhabitants are indebted to the dew for a great portion of the water they receive. By its formation also the atmosphere is relieved of much of the aqueous vapour it contains, and is thus fitted to perform many important operations that would not otherwise take place.

Dew for a length of time was thought to descend to the earth in the same manner as rain. Not many years ago even Dr. Hutton defined it to be "a thin, light, insensible mist, or rain, ascending with slow motion, and falling while the sun was below the horizon, differing from rain only as it was greater or less in quantity."

From a series of observations made by Dr. Wells, during a period of two years, Dr. Hutton's theory has been proved incorrect. Dew does not descend to the earth as a light rain, nor in the same form that we perceive it on the grass or other objects. When first observed, it appears as very small irregularly-shaped flat spots, which gradually increase in size, and joining others, form small globules, to which the term dew-drops is generally applied.

Dew forms more readily, and in greater quantity, on some bodies than it does on others. Vegetables will have dew copiously deposited on them when metallic substances will be entirely free from it. The metals appear, indeed, to be the worst possible substances for the deposition of dew. The process is also only found to take place under certain circumstances. High winds and a cloudy sky will entirely prevent it; while it proceeds most favourably when the sun is below the horizon. A considerable quantity is, however, formed a little after sunrise, and also before sunset.

From a consideration of these circumstances, and after performing a variety of experiments, Dr. Wells has proposed a theory, which is described by Dr. Thomson as "one of the most beautiful examples of inductive reasoning in the English language." It is but fair to state, however, that a writer on the subject, in the Encyclo. Brit., does not consider the conclusions from the experiments so exact as might have been obtained, although he admits their general correctness. The theory will be understood, perhaps, by the following explanation:—

It is a well-known law of heat that it always has a tendency to diffuse itself equally throughout all bodies; and if, therefore, different substances on the surface of the earth cool down to a lower degree of temperature than that of the atmosphere at the time, the latter will part with a portion of its heat to them. Now we stated in the article on Rain (No. I., p. 4), that the air was continually receiving, by evaporation from the water on the earth, a considerable quantity of aqueous vapour, and that when the air was warm it would contain a much greater quantity than when it was of a low temperature. It will, therefore, at once be seen, that if the air be cooled gradually, the vapour will be deposited in like manner; and this is the cause of the formation of dew. Directly the sun descends below the horizon, and a little before this, and for a short time

after sunrise, as just stated, different substances on the earth begin to radiate, or give off the heat they have received during the day into space. The atmosphere has its temperature but very little affected by this means; and if the sky is unclouded, and the air still, the body that radiates its heat soon becomes cooler than the atmosphere, which immediately begins to impart to them a portion of its heat. Its temperature is thereby reduced; it can no longer hold the same quantity of vapour in solution that it did previously, and it is then deposited in the form of a dew. The reason it does not form when the nights are cloudy is, because clouds prevent the radiation of heat from the earth. If the wind is high it will also prevent dew being deposited. Perfect stillness of the atmosphere is not absolutely necessary, for the gentle motion of the air, pregnant with moisture, facilitates the disengagement of dew, since fresh parcels of it will be brought more frequently into contact than if the atmosphere were entirely calm; but on any agitation approaching to wind, the deposition ceases.

During spring and autumn dews are most abundant in this country; and it is in these seasons that there are the greatest differences in the temperatures in day and night. The average quantity of dew deposited in this country is estimated at a depth of five inches, being about one-seventh of the mean quantity of moisture supposed to be received from the atmosphere, over all Great Britain, in the year, or about 22,161,337,335 tons, taking the ton at 252 imperial gallons.

When the dew freezes, as it frequently does at this period of the year, it presents the very beautiful appearance termed hoar frost, the forms of which are among some of the most beautiful objects for the microscope.

## THE HUMAN BODY.

SECOND ARTICLE.

In our last paper on this subject, we described the principal means by which the change of structure that is constantly taking place in our bodies, was effected. The *material* out of which this waste is supplied, is the blood, the properties of which we will now bring before the notice of our readers.

Every portion of the body is formed from the blood; whether it be bone or muscle; tendon or skin; the hair on our heads, or the brains within them—these, and every other solid and every fluid in the body, are formed from the blood. This is itself produced from the food we eat, by a process termed digestion, into which we shall not however enter at present. The ordinary appearance of blood, as it flows from a wound is familiar to every one. It is red and rather glutinous to the touch. It does not however possess a red colour in all living beings. In insects it is generally colourless: in the caterpillar it is *green*. In fish it is colourless, excepting at the gills. Some physiologists have in consequence proposed to confine the term blood to that fluid in man alone, but, as all animals have a circulating fluid, agreeing in its principal qualities with that of man, we see no occasion for the distinction. In plants it is termed sap. The colour of the blood has been attributed to various causes. Dr. Prout says, it is in consequence of its containing iron, which becomes oxydized by exposure to the atmosphere in the lungs; and he has calculated, from some experiments performed by him, that the blood in the bodies of forty men contains enough iron to make a ploughshare. Other celebrated chemists have denied that the colour is produced by an oxide of iron, and maintain that it is owing to the presence of a vegetable colouring, which gives a peculiar hue to the blood, as it does to the rose, or to the violet. Colour, however, does not appear to have any very great influence on the nutritive quality of the blood, since we find that some parts of the body are nourished by that which is colourless. For instance, the cornea, or white part of the eye, is supplied with bloodvessels, and has a circulation constantly going on through it, yet, unless the eye becomes what is termed "blood-shot," there is no appearance of a circulation; still we know that it takes place as certainly in the one case as the other, since no part of the body could remain alive unless it was supplied with blood. If a person views a drop of this fluid through a microscope, he will find that it contains an immense number of small globules. These are the causes of the colour. They have been computed at less than the six thousandth part of an inch in diameter, and we may therefore form some idea of the minuteness of those vessels of the eye that will not admit even such minute bo-

dies as these to pass this. They are larger in some animals than they are in man, and are said to be larger in fish than in other living creatures.

Although, as we have stated, every part of the body is formed out of the blood, yet it must not be supposed that it contains bone, muscle, cartilage, &c., as we find them in different parts of the body. It does not contain these, but it contains the elementary substances out of which they are formed. Thus it contains phosphate of lime and alburnem, which united together in certain proportions, form bone; and the same with respect to the other solids and fluids of the system.

The quantity of blood in the body of an individual is almost impossible to ascertain with precision, since it will of course vary according to the quantity of food that is eaten, and a variety of other circumstances, such as the state of activity of the secretary organs, and condition of the digestive powers. From the best calculation that can be made under these circumstances, it appears that an adult, in good health, contains about thirty pounds of blood. With respect to its temperature, we have much better data to reason upon, since it is found to be very nearly the same in men in every part of the earth. The inhabitant of a country on the equator, will be found to possess a temperature but very little exceeding that of persons in England, —and the natives of Greenland, and other parts of the frigid zone, do not materially differ in animal heat from ourselves. The temperature of man is found to be about 98°. Some animals are warmer. The duck, for instance, raises the thermometer to 107°.

Although we have spoken of the blood as a fluid in all respects similar, yet there are, indeed, two kinds of blood in the body: the one is termed arterial, and the other venous. The first is of a bright red colour, and is found in the arteries of the body; the other is of a dark purple colour, and circulates through the veins. The cause of this difference in colour will be described when we consider the effects of respiration; it is merely mentioned now to prevent any misunderstanding on the subject; for both venous and arterial blood possess, in common, all the properties we have been describing.

In our next paper on this subject we shall notice the process of coagulation, and the other constituents of the blood not yet mentioned.

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*To the Editor of the Penny Mechanic.*

SIR,—In the third Number of THE PENNY MECHANIC there appeared a "Quere" respecting "The cause of the rise of sap in trees, and is it to be accounted for on the principle of capillary attraction?" Having paid attention to this subject, and for the information of those ignorant of the opinion of naturalists, I subjoin the following remarks; which, if you think worthy of a place in your pages it will fully compensate yours, obediently,

*Strand, Nov.* 28. EYTON.

Naturalists have attributed the ascent of sap in vegetables to different causes; some to the action of temperature upon the fluid, which action will cause it to ascend by a diminution of its own gravity; some to the *capillary attraction.* But the most generally-received opinion of the cause of its ascension is, that the sap itself exerts an exciting action upon the irritable fibres of the vessels, and by their contraction the fluid is forced upwards. Nevertheless the sap, in its ascent, varies with the heat and state of the atmosphere as well as the season of the year. During the winter months it is suspended, but on the approach of spring it again commences vigorously, and more particularly at that period, causing the full expansion of the leaf.

De Stales found, by experiment, that by affixing, in a proper manner, glass tubes to a branch of the vine, in the heat of the day, the sap would ascend, or rise in these tubes at the rate of an inch in three months, and attain a height of more than twenty feet; and that the force of the sap upwards would sustain a column of mercury of thirty-eight inches, which would require a column of water of more than forty feet. The Doctor further remarks, that this force is five times greater than the blood's force in the canal artery of the horse, seven times that of the like in the dog, and eight times greater than the blood's force in the same artery in the fallow deer.

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## SCHOOL OF DESIGN.

WE have received the following communication from a correspondent.

*To the Editor of the Penny Mechanic.*

SIR,—I should be exceedingly obliged if you could give me any information, through the medium of your valuable periodical, (which I think has long been wanted), relative to the time of opening of the new School of Design, the place where it is to be held, and the class of persons for whom it is intended.

I remain your sincere well-wisher

16*th Nov.* 1836. A CITY APPRENTICE.

The School of Design mentioned by our correspondent is about to be formed, under the patronage of Government, for the purpose of instructing artisans in a knowledge of the arts connected with our manufactures. The session of Parliament before last, a Committee of the House of Commons was appointed to "inquire into the best means of extending a knowledge of the arts and of the principles of design amongst the people, especially the manufacturing population." From the evidence given before that Committee, and which has lately been published, it appeared that our workmen were much in want of knowledge of the kind mentioned; and in consequence, it is supposed, of this evidence, the Chancellor of the Exchequer, last session, moved the grant of a sum of 1500*l.* for the purpose of establishing a "School of Design." We have not been able to learn when the School is to commence, but directly we do so we shall not fail to notice it. In the mean time the following particulars may be useful; and as they are taken from official documents they may be relied on.

The management of the new school is to be entrusted to a body of persons well informed in the arts, subject to the regulations of the Board of Trade as to the administration of the grant. The Establishment is to consist of a curator or director, two masters, with one or more attendants.

The duty of the curator will be to select proper objects for the museum, and to submit estimates of the expense to the Board of Trade; to take charge of such objects, whether purchased or presented; and, above all, to give, at stated periods, by way of lecture, instruction on the specimens to the scholars generally, to which lectures the public shall have the right of admission on paying a small fee.

The two masters should be of a different order of attainments, and employed accordingly.

It is proposed to divide the school into four classes, of two of which the iniatory teacher should have the charge, the principal teacher having the charge of the others.

The classes of the iniatory teacher will be,—

1st. Of drawing in outline perspective, and drawing-board practice.

2nd. Of the same, with the addition of light and shade.

The classes of the principal teacher will be,—

3rd. Of the above, with the addition of water and body colour.

4th. Of composition and imaginative design generally.

It is supposed that the scholars who will apply for admission in the first instance will draw moderately well, and that of them there will be a sufficient number to make at once a class of each description.

But it may be necessary, in addition to the above provision of two teachers, to provide for the appointment of a lecturer, occasional or otherwise, to give special instruction in the chemistry of colours, as well as other necessary arts.

The school should be supplied with a proper collection of books, with casts of the best ornamental works, and a collection of accurate and well-coloured drawings and prints on botany and zoology.

The best of our own and foreign manufactured articles are also to find a place in the Institution.

By these combined means, with the aid of an annual exhibition, and probably of premiums and nominal rewards to successful scholars, the experiment will have sufficient trial, and the ultimate results upon art may safely be left to the operation of those influences which have hitherto governed the progress of all kind of enterprise in this country.

## MANUFACTURE OF SUGAR.

The sugar cane affords most of the sugar which is consumed in Europe. The ripe canes are crushed between two iron cylinders placed perpendicularly. The expressed juice falls on a plate beneath, whence it flows into a caldron, where it is boiled with wood-ashes and lime, and the scum taken off. This boiling with ashes and lime is repeated in three other boilers, which process converts it into syrup. It is then strongly boiled with lime and alum, and when sufficiently concentrated is poured into hogsheads pierced at the bottom with many holes, to let off the molasses, which will not crystallize. These holes are afterwards stopped with canes, as we see them when the hogsheads are imported. The sugar as it cools, becomes solid in the casks, and is called *Muscovado* sugar. It afterwards undergoes in Europe several refinings in order to form it into loaf sugar.

Oxygen is absolutely necessary for the formation of sugar, which is a vegetable oxide. If it were deprived of the greater part of this oxygen, it would lose its sweetness, and would be no longer sugar,

but a singular kind of substance possessing properties more analogous to gum than sugar. Mr. Cruickshank has effected this change on sugar by means of phosphuret of lime, which has a very strong attraction for oxygen; though he was not able to reproduce sugar by the union of gum with oxygen.—*Parks.*

*London Mechanics' Institution.*—A general quarterly meeting of this Institution was held on Wednesday, 7th December, Dr. Birkbeck in the chair. The Committee presented their Report, by which it appeared that the receipts during the quarter had amounted to upwards of 450*l.*, that 50*l.* had been paid off the building debt, and that 108*l.* 9*s.* 9*d.* remained in hand. During the last twelve months 1949*l.* 10*s.* 10*d.* had been received, and 1851*l.* 1*s.* 1*d.* expended. 221*l.* had been paid to lecturers alone. The number of members at the end of last quarter was 1063; there had been 399 new members elected, and 227 had ceased paying their subscription, the present number was therefore 1249. After the Report had been read, a member who had been expelled the Institution for misconduct by the Committee, appealed against their decision to the members, and after a prolonged discussion was reinstated. An adjournment then took place till Thursday evening, when the members passed a resolution to the effect, that the Committee should not have the power of closing the door of the room in which they met against the members, on any occasion. A further adjournment took place till Saturday, when this resolution was modified, so that it should not be acted upon when the estimates of tradesmen were being discussed. Some motions that were intended for discussion were postponed till next quarterly meeting, and the meeting then adjourned.

*Effects of Intense Cold.*—In Iceland and some other northern countries, the thermometer frequently falls to zero, which is 32 degrees below the freezing point. At Hudson's Bay it has been known to sink even 50 degrees lower. When stones or metals, which have been exposed to such degrees of cold, are touched by the tongue, or the softer parts of the human body, they absorb the heat from those parts with such rapidity, that the flesh becomes instantly frozen and mortified, and the principle of life in them is extinguished. Some French academicians who made a journey to the northern end of the Baltic, and wintered under the polar circle, found it necessary to use all possible precautions to secure themselves from the dreadful cold which prevailed. They prevented, as much as possible, the entrance of the external air into their apartments; and if at any time they had occasion to open a window or a door, the humidity of their breath, confined in the air of the house, was condensed and frozen into a shower of snow; their lungs, when they ventured to breathe the cold air, felt as if they were torn asunder; and they often heard the rending of the timber around them by the expansive power of the frost on the fluid in its pores.

## INSTITUTIONS.

LECTURES DURING THE WEEK.

*London Institution*, Finsbury Circus.—Tuesday evening, Dec. 20, at seven o'clock Dr. Birkbeck on Insects.—Thursday afternoon, Dec. 22, at one, W. Chalklen, Esq., on Taste.

*London Mechanics' Institution*, Southampton-buildings, Chancery-lane.—Wednesday, Dec. 21, at half-past eight, Lecture on Juries and Witnesses.—Friday, Mr. Haydon on the Fine Arts.

*Aldersgate Street Institution.*—Wednesday, Dec. 21, at half past eight, Robert Adams, Esq., on Optics.

*Western Literary and Scientific Institution*, 47, Leicester-square.—Thursday, Dec. 21, C. Pemberton, Esq., on Elocution.

*Lambeth Literary and Scientific Institution*, Waterloo Bridge road.—Tuesday evening, Dec. 20, at half-past eight o'clock, D. Cooper, Esq., on Cryptogamic Botany.

*Islington Literary and Scientific Society.*—Thursday, Dec. 22, at eight o'clock, Mr. Severn, on Music, with illustrations.

*Eastern Literary and Scientific Institution*, 88, Hackney-road.—Tuesday, Dec. 20, G. S. Sacket, Esq., on Astronomy.

*Mutual Instruction Society*, Great Tower-street.—Monday, Dec 19, at eight o'clock, Mr. Thomas, on the Steam Engine.

### TO CORRESPONDENTS.

"Mr. King" we shall be happy to hear from. Apply at the Society of Arts, Adelphi.

"C. H. S.'s" article we will find room for shortly if we can.

We did not receive the account of the Meteorological Society in time.

"R. L.'s" letter should have been addressed "To the Editor." We have no objection to his wish.

Received "J. L.," "Mr. Gorbell," "A. E.," and "J. G."

Communications requiring immediate attention should be sent to the Publisher's by Tuesday afternoon.

Next week we hope to fulfil our promise of giving a view of the opening of the Greenwich Railway, which took place on Wednesday last. Our artist was present on the occasion, and will, we trust, enable us to present our Readers with a very spirited representation of that imposing spectacle.

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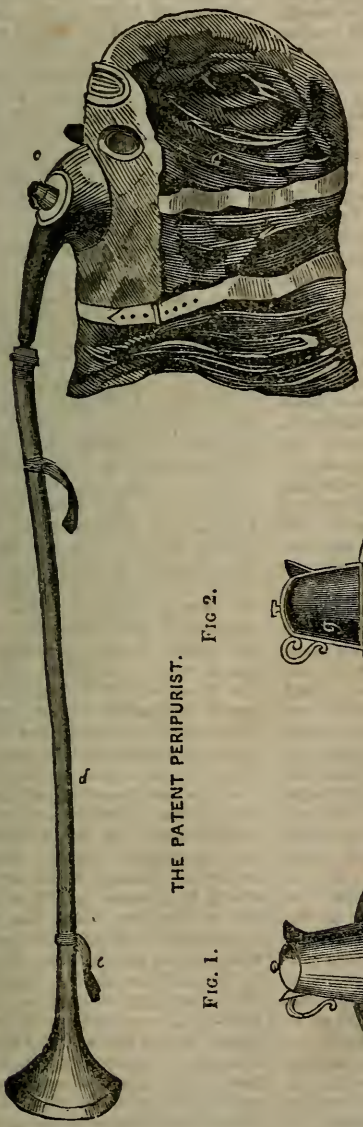
# THE PENNY MECHANIC.

A MAGAZINE OF THE ARTS AND SCIENCES.

No. XXVII.] SATURDAY, APRIL 29, 1837. Vol. I.




ROBERTS' HOOD AND MOUTH-PIECE.

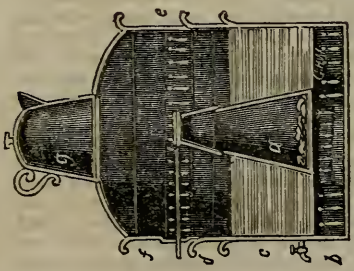



Fig 2.

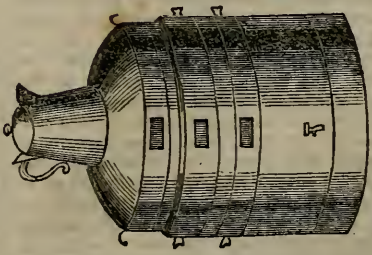


Fig. 1.

THE PATENT PERIPURIST.



Holloway Press: D. A. Doudney.

## ROBERTS' HOOD AND MOUTH-PIECE.

The object of this instrument is to enable a person to enter with safety the rooms of a house when on fire, although such rooms may be full of smoke, which would instantly suffocate him unless protected by the hood and mouth-piece. The inventor, Mr. Roberts, is an ingenious working mechanic, who besides the above useful piece of apparatus, has invented another means of protecting human life when exposed to imminent peril. We allude to his improvement of Sir Humphrey Davy's safety lamp; of which lamp we gave an engraving a short time since. Whether Sir Humphrey Davy's lamp is really so dangerous as it is represented to be, is perhaps a question of some doubt. But there can be no question that as improved by Mr. Roberts it is perfectly safe. We mention this invention, although but remotely, if at all connected with the subject of this article, because we fear that Mr. Roberts has not received the patronage of which his talents are deserving. The hood and mouth-piece is an example of his ingenuity. By providing every fireman with one of them, property to a great amount that is now destroyed might be preserved, and not property alone, but often human life. More than one melancholy instance has lately occurred where for the want of the means of entering a room filled with suffocating smoke, life has been sacrificed. In the front page we give an engraving of the instrument that will enable a person to do this. It consists of a leather cap or hood, *a*, which entirely covers the head and face, with strong glasses before the eyes. The lower part of the hood is padded with soft cotton, covered with wash leather, which being drawn tight round the neck by a strap and buckle, excludes the surrounding air. The upper part of the proboscis, *b*, is of sufficient capacity to include the nose and mouth of the wearer, and forms the channel through which he respires. A trumpet-mouthed orifice is formed at *c*, provided with a good cork stopper, which is secured by a small brass chain; the use of this appendage is to afford a ready relief to the lungs, without taking off the hood when the wearer goes to the door or window of a building on fire, for the purpose of respiring a purer atmosphere, or to consult with persons on the outside. Below this part is attached, by means of an union joint, a flexible tube, *d*, about two feet six inches long, and terminating in a funnel five inches in diameter, in which is contained a sponge saturated with water. The flexible pipe is kept distended by a spiral coil of wire, and the straps *e e* are for the purpose of buttoning it to the dress of the wearer, so as not to encumber him, or impede his exertions. The operation of the apparatus is as follows:—The gaseous and other noxious matters which exist in the apartment, are, by the act of inspiration, obliged to pass through the funnel of the tube, where they are absorbed and neutralized by the liquid contained in the sponge, and the air is sent up to the lungs in a pure state. The efficacy of the apparatus has been repeatedly proved, in the presence of numerous scientific individuals, amidst the most dense smoke, arising from the combustion of wool, wet hay, wood shavings, &c., besides large quantities of sulphur, in temperatures varying from 90 to 240° of Fahr.

## THE PATENT PERIPURIST.

This very ingenious piece of apparatus, if more generally adopted, would be found exceeding useful in culinary operations. The patentee, Mr. Wells, states in his prospectus of it, that "it boils water, prepares coffee and chocolate in a very superior manner, boils eggs, cooks a beef-steak or a slice of ham, all in less than ten minutes. For dinner, it will prepare soup, steam vegetables, and cook fish, chops, or steaks, at the same time; and for these one farthing's worth of fuel is sufficient." Fig. 1, is an external view, and fig. 2 is a vertical section; *a* is a small cone of cast iron, having at the bottom a grating, on which is put the fuel (charcoal), broken into small pieces; below this a small chamber, *b*, perforated at its sides for the admission of air, and containing a small pan to receive the ashes, and also to light the charcoal by a piece of paper; the vessel *c* contains water, which entirely surrounds the cone; the next vessel *e* above is intended to be used as a steamer; it has in its centre a frustrum of a cone, the lower edges of which descend below the bottom of the vessels, and fit upon the cone beneath, so as to carry up the flue to the chamber above, which has open perforated sides, whence the vapours produced by the combustion escape. On the top of the cone there is a valve for enlarging or diminishing the aperture, having a horizontal rod fixed to it, which passes to the outside of the vessel, as shown. The vessel over this, *f*, is, we suppose, a stew-pan, or something of the kind; it is heated by the hot air and direct influence of the fire; above this pan is placed in a cavity of the cover a small pot for warming small quantities of liquid. There are several appendages or vessels for peculiar purposes, such as the boiling of eggs, &c.

which fit one over another in a similar manner to those described. The apparatus is proposed to be used on the breakfast or dining-table, to be taken in a carriage, in a boat, or carried by pedestrians.

## PLANTS GROWING DOWNWARDS.

*To the Editor of the Penny Mechanic.*

SIR,—Sometime since I learnt from one of the papers, that the supposition that plants would not grow with their roots upwards, had been proved incorrect, and that at a florist's in Cheapside, near the New Post Office, a flower might be seen *growing downwards.* This I found to be the case; and lately the flower (a hyacinth), bloomed. The peculiar manner in which this flower has grown, induced me to give it a glance when I passed the shop in the morning, and to my surprise, I perceived that every day or two the hyacinth changed colour: one day it was blue, and then pink, then white, and I don't know how many more colours. It struck me at first, that some trick had been performed to make the flower *appear* to grow downwards; but on consideration I can hardly suppose this to be the case. I therefore request the favour of the insertion of this letter, in order to know whether any of your readers have tried and succeeded in making plants grow downwards, as I suppose it is not a matter of any very great difficulty, since the florist before mentioned, can change the flower every two or three days.

Yours obediently,

COMEO.

## A DIVING APPARATUS.

A DIVING apparatus was invented during the American war by a Mr. Bushnel, of Connecticut, called a submarine vessel, the use of which was to blow up and destroy the British ships and vessels employed in the American war. The external shape bore some resemblance to upper tortoise-shells of equal size joined together. The inside was capable of containing the operator, and air sufficient to support him 30 minutes without receiving fresh air. At the bottom opposite to the entrance, was fixed a quantity of lead for ballast. At one edge, which was directly before the operator, who sat upright, was an oar for rowing forward or backward. At the other edge was a rudder for steering. An aperture at the bottom with its valve, was designed to admit water for the purpose of descending; and two brass forcing pumps served to eject the water within, when necessary for ascending. At the top there was likewise an oar for ascending or descending, or continuing at any particular depth. A water gauge, or barometer, determined the depth of the descent, and a compass directed the course, and a ventilator within supplied the vessel with fresh air.

When the navigator would descend, he placed his foot upon the top of a brass valve, depressing it, by which he opened a large aperture in the bottom of the vessel, through which the water entered at his pleasure; when he had admitted a sufficient quantity, he descended gradually; if he admitted too much, he ejected as much as was necessary to obtain an equilibrium, by the two brass forcing pumps. When he had obtained an equilibrium, he could row up or down, or continue at any particular depth, with the oar placed near the top of the vessel, formed upon the principle of a screw, the axis of the oar entering the vessel; by turning the oar one way he raised the vessel, by the other way he lowered it. The internal shape of the vessel verged towards an ellipsis, as near as the design would allow; but every horizontal section, although elliptical, was as near a circle as could be admitted. The body of the vessel was made exceedingly strong; and, to strengthen it as much as possible a firm piece of wood was framed, paralled to the conjugate diameter, to prevent the sides from yielding to the great pressure of the incumbent water, in a deep immersion. In the fore part of the brim of the crown of the machine, was a socket, and an iron tube passing through the socket; the tube stood upright, and could slide up and down in the socket of six inches; at the top of the tube was a wooden screw, fixed by means of a rod which passed through the tube, and screwed the wood fast upon the top of the tube; by pushing the wood screw up against the bottom of a ship, and turning it at the same time, it would enter the planks; when the wood screw was firmly fixed, it could be cast off by unscrewing the rod which fastened it upon the top of the tube. Behind the submarine vessel was a place, above the rudder, for carrying a powder magazine, large enough to contain 150 lbs. of powder, with apparatus used in firing it, and was secured in its place by a screw. A strong piece of rope extended from the magazine to the wood screw above mentioned, and was fastened to both. When the wood screw was fixed, and to be cast off from its tube, the magazine was to be cast off likewise by unscrewing it, leaving it hanging to the wooden screw; it was lighter than the

water that it might rise up against the object, to which the wood screw and itself were fastened. Within the magazine was an apparatus constructed to run any proposed length of time under twelve hours; when it had run out its time, it unpinioned a strong lock resembling a gun-lock, which gave fire to the powder. This apparatus was so pinioned that it could not possibly move, till, by casting off the magazine from the vessel it was set in motion. The skilful navigator or operator could swim so low on the surface of the water, as to approach very near a ship, in the night, without fear of being discovered, and might if he choose, approach the stem or stern above water, with very little danger. He could sink very quickly, keep at any depth, and row a great distance in any direction he desired, without coming to the surface; and when he rose to the surface, he could soon obtain a fresh supply of air, when, if necessary, he might descend again and pursue his course. The first experiment was made with two ounces of powder, which were exploded four feet under water, to prove that powder could be exploded under water. The second experiment was made with two pounds of powder, inclosed in a wooden bottle and fixed under a hogshead, with a two-inch oak plank between the hogshead and the powder. The hogshead was loaded with stones as deep as it could swim; a wooden pipe descending through the lower head of the cask, and through the plank, into the powder contained in the bottle, was primed with powder. A match put in the priming exploded the powder, which produced a wonderful effect, rending the plank into pieces, demolishing the hogshead, and casting the stones many feet into the air. After many other similar experiments, the operator was made to descend, and continue at particular depths, without rising or sinking, row by the compass, approach a vessel, go under her and fix the wooden screw, before mentioned, into the bottom, &c., until he was thought sufficiently expert to put any design into execution.

C. H. S.

## BIOGRAPHICAL SKETCHES.

### JAMES BRINDLEY.

A MAN of talent, it is said, may be made so by circumstances, but a man of genius must be formed by nature. Some men are born poets; some philosophers; but the subject of our present sketch was born a *Mechanic!* And if ever there has been an instance of natual genius, of genius which in defiance of every difficulty that could be opposed to its development, succeeded in benefiting mankind and procuring for its possessor a name that will never be forgotten, such an instance is afforded us in the life of James Brindley.

To become successful as an engineer requires in most men a high degree of mental cultivation; unwearied assiduity in their profession, and extensive mathematical knowledge; yet the subject of our sketch has been truly described as "in appearance and manners, as well as acquirements, a mere peasant. Unlettered, and rude in speech, it was easier for him to devise means for executing a design, than to communicate his ideas concerning it to others." Yet notwithstanding these great, and what would have been to most men, insurmountable difficulties, Brindley triumphed over all, and earned for himself a reputation that is not excelled even by the most renowned of those who have had all the advantages that education can bestow, to second the exertions of their genius. The lesson his biography conveys we will let our readers discover for themselves; but we cannot forbear reminding them, that the poorest and the least educated amongst them have far less difficulties to contend with than those which beset the early life of Brindley.

This highly ingenious individual (whose superior judgment in planning canals, coupled with ability for surmounting every difficulty that occurred to impede their progress, will be perpetuated as long as the history of inland navigation lasts,) was born at Tunstead, a hamlet in the parish of Tideswell, Derbyshire, in the year 1716. Although his father originally possessed a small freehold, the destructive consequences of an attachment to sporting had compelled him to alienate his property, and young Brindley's education was not only neglected, but he was moreover reduced to the necessity of contributing to support the family by the lowest occupations of rustic labour. About his seventeenth year, however, this rising genius apprenticed himself to a mill-right, named Bennet, who resided at Macclesfield, in Cheshire; where his predilection for mechanics soon began to develop itself, in the invention and execution of various pieces of work, which were accomplished by him without his having obtained any previous instruction. Continuing to produce satisfactory proofs of his advancing acquaintance with the principles of mechanism, evidenced by the improvements which he introduced, his master, at the expiration of his apprenticeship, at once confided to him the management of his business.

Commencing trade for himself, some years after, Brindley soon extended the reputation of his skill; so that, in 1752, he was employed to erect a water-engine of unusual powers, for the purpose of draining certain coal-mines in the neighbourhood of Clifton, in Lancashire. Here he immediately manifested that peculiar ability for which he became so singularly eminent; for he succeeded in the arduous project of driving a tunnel through a rock nearly six hundred yards in length, in order to convey a stream of water from the river Irwell, which was to effect the turning of a wheel fixed thirty feet beneath the surface of the earth. During the year 1755, Mr. Brindley was solicited to execute the larger-wheels for a silk-mill at Congleton; when the mechanist who had been engaged to organize other parts of the machinery, and to superintend the whole, proving to be incompetent, the entire structure was committed to Mr. Brindley. He not only executed the original plan in a masterly manner, but introduced several curious and valuable improvements, as well in the construction of the engine itself, as in making the wheels and pinions belonging to it. Probably about the same time, the flint-mills in the Staffordshire potteries received several improvements from his ingenuity. In 1756, he undertook the erection of a steam-engine upon a new plan, at Newcastle-under-Line; and was sedulously engaged in this work, when, fortunately for the community, his attention was demanded for objects of higher importance, and successfully directed to undertakings more calculated to display the boldness of his genius.

Francis Duke of Bridgewater having, before he became of age, determined to attempt the then hazardous enterprize of carrying a canal from his works at Worsley to Manchester, had no sooner succeeded his brother, in the title and estates of his house, than he was induced, owing to the extended celebrity of Mr. Brindley, to consult with him on the practicability of his design. Thoroughly satisfied as to the capability of this self-taught genius, the Duke had discernment enough to entrust to him the unfettered direction of this arduous undertaking. Brindley having surveyed the estate at Worsley and pronounced the projected navigation to be practicable, an Act of Parliament was accordingly obtained for making a navigable canal from Salford, near Manchester, to Worsley. Confiding in his own mind, Brindley here "projected and adopted those leading principles, for the execution of these kind of works, which he ever afterwards adhered to, and in which he has been imitated by all succeeding artists. To preserve, as much as possible, the level of his canals, and to avoid the mixture and interference of all natural streams, were projects at which he constantly aimed. To accomplish these, neither labour nor expense were spared; and his genius seemed to delight in overcoming all obstacles, by the discovery of new and extraordinary contrivances. Encouraged by the complete success of his first line of canal, the Duke of Bridgewater obtained an act for extending it, from the river Worsley, over the Irwell, to Manchester; and which he afterwards extended to the Mersey. This canal, which is ninety-three miles long, begins at Worsley Mill, about seven miles from Manchester, where the Duke cut a bason capable of holding all his boats. The canal enters a hill by a subterraneous passage, large enough for the admission of flat-bottomed boats, which are towed along by hand-rails, near a mile under ground, to his coal-works; then the passage divides into two, both of which may be continued at pleasure. This passage is in some places cut through the solid rock, and in others is arched with brick. Air-funnels are cut in several places to the top of a considerable eminence. The arch at the entrance is about six feet in breadth, and widens in some places for the boats to pass each other: the boats are loaded from waggons, which run upon rail-ways. Sometimes this canal is carried over public roads, by means of arches. One of the most stupendous works on this canal is the aqueduct over the river Irwell, where the canal runs upwards of forty feet above the river; and where the barges are seen passing on the canal, whilst the vessel in the river are also in full sail under them! About three miles from Worsley, begins this amazing aqueduct; which is carried two hundred yards over a valley.

## MANUFACTURES.

### PAINTING ON GLASS.

The art of tinging glass by protoxide of copper flashing it on crown-glass, has of late years been revived by the Tyne Company in England, at Choisy in France, and in Suabia in Germany, and in 1827 the Academy of Arts at Berlin gave a premium for an imperfect receipt. To what extent modern glass-painters make use of these new glasses I am ignorant; the specimens that I have seen were so strongly coloured as to be in parts al-

most opake, but this is a defect which might no doubt be easily remedied.

Though it is difficult to produce the copper glass uniformly coloured, it is easy to obtain streaks and patches of a fine transparent red. For this purpose it is sufficient to fuse together 100 parts of crown-glass with one oxide of copper, putting a lump of tin into the bottom of the crucible. Metallic iron employed in the same way as the tin throws out a bright scarlet, but perfectly opake. I shall now conclude these observations by a few notices respecting glass tinged by fusion with gold, which, though never brought into general use among glass-painters, has I know been employed in one or two instances, flashed both on crown and also on flint-glass. Not long after the time when the art of making the copper-red glass was lost, Kunckel appears to have discovered that gold melted with flint-glass was capable of imparting to it a beautiful ruby colour. As he derived much profit from the invention, he kept his method secret, and his successors have done the same to the present day. The art, however, has been practised ever since for the purpose of imitating precious stones, &c., and the glass used to be sold at Birmingham for a high price under the name of *Jew's glass.* The rose-coloured scent-bottles, &c. now commonly made, are composed of plain glass flashed or coated with a very thin layer of the glass in question. I have myself made numerous experiments on this subject, and have been completely, and at last uniformly, successful in producing glass of a fine crimson colour. One cause why so many persons have failed in the same attempt, I suspect is that they have used too large a portion of gold; for it is a fact, that an additional dust of gold, beyond a certain point, far from deepening the colour, actually destroys it altogether. Dr. Lewis states that he once produced a potfull of glass of beautiful colour, yet was never able to succeed a second time, though he took infinite pains, and tried a multitude of experiments with that view. I have found that a degree of heat, which I judge sufficient to melt cast-iron, is not strong enough to injure the colour. It would appear, that in order to receive the colour it is necessary that the glass should contain a proportion either of lead, or of some other metallic glass. I have found bismuth, zinc, and antimony to answer the purpose, but have in vain attempted to impart any tinge of this colour to crown-glass alone.

Glass containing gold exhibits the singular change of colour on being exposed to a gentle heat, as has been already noticed with respect to glass containing copper. The former when taken from the crucible is generally of a pale rose-colour, but sometimes colourless as water, and does not assume its ruby colour till it has been exposed to a low red-heat, either under a muffle or in the lamp. Great care must be taken in this operation, for a slight excess of fire destroys the colour, leaving the glass of a tingy brown, but with a blue transparency, like that of gold-leaf. These changes of colour have been vaguely attributed to change of oxygenation in the gold; but it is obviously impossible that mere exposure to a gentle heat can effect any chemical change in the interior of a solid mass of glass, which has already undergone a heat far more intense. In fact I have found the metallic gold gives the red colour as well as the oxide, and it appears scarcely to admit of a doubt, that in a metal so easily reduced, the whole of the oxygen must be expelled long before the glass has reached its melting point. It has long been known that silver yields its colour to glass while in the metallic state, everything leads one to suppose that the case is the same as gold.

There are still some other substances by means of which I find it is possible to give a red colour to glass, and that is a compound of tin, chromic acid, and lime; but my trials do not lead me to suppose that glass thus coloured will ever be brought into use.

## NATURAL PHENOMENA.

### ECLIPSES.

All uninformed persons regard eclipses with some degree of terror, and among savages it is customary to make a great noise during the occurrence of the phenomena, in order to prevent the evil which they suppose would otherwise inevitably result. A late writer has very truly remarked that in times of ignorance men are alarmed at all celestial phenomena, the recurrence of which takes place at periods too remote to be readly calculated, and which accordingly appear to be guided by no fixed laws; whilst more important and obvious appearances excite no surprise because they are frequent, and because they occur at well-known periods: thus the changes of the moon are observed without alarm, while the less obvious occurrence of an eclipse has scattered dismay over an army or a nation. An in-

cidental and considerable assistance has been derived to chronology from this superstitious feeling. Eclipses were thought to be connected, in some secret manner with the destinies of nations, and their occurrence has been carefully recorded, when near the time of some great battle or other political event, of whose epoch we should otherwise remain in ignorance. Astronomical science shows how to determine with the greatest exactness the hour of any given eclipse; and we are thus enabled to fix with precision the date of any event which may have been thus accompanied, to confirm the statement of an historian, or to correct his errors. But as the computation of eclipses is attended with considerable difficulty, a few only of the readers of history are able to carry on these researches for themselves. On this account catalogues of eclipses have been calculated by astronomers for many thousand years, by a reference to which any chronological point connected with these phenomena may be at once determined.

Eclipses take place every half year, and at each period there may be one, two, or three eclipses; if one only, it must be an eclipse of the sun; if two, there will be one of each luminary; and if three, there will be two of the sun, with one of the moon between them.

The sun is eclipsed whenever the moon comes between it and the earth, so that the eye of a spectator on the earth, is in a straight line with the centres of the sun and moon. Sometimes what is called our annular eclipse takes place, such as that of the 15th May last year, when a ray of light appears round the disk of the moon. This is in consequence of the apparent diameter of the moon being less than that of the sun; at other times it is greater, and then a total eclipse takes place.

The moon is eclipsed, as it was last week, whenever the earth comes between it and the sun; in consequence of which it is deprived of the light of that luminary. As the moon revolves round the earth once in every twenty-eight days, it might at first be supposed that an eclipse would take place once in every month, as the moon must during that period pass between the earth and the sun. This would be the case only the moon does not pass in an exact line between the earth and the sun: the inclination of the orbit of the moon to the plane of the ecliptic prevents this occurrence taking place so often; but whenever the moon passes the earth in an exact line with the sun, that is whenever the three bodies are in an exact line with each other, the moon is eclipsed.

Every eighteen years and ten or eleven days the order in which eclipses occur is the same as that of the previous eighteen years. It might therefore be imagined that a correct list of eclipses for eighteen years would be sufficient for all purposes; as by adding the ecliptic period as many times as required, the period of an eclipse might be known at any distance of time. This would be correct if every eclipse appeared under precisely the same circumstance as its corresponding eclipse in the preceding or following period; but this is not the case. An eclipse of the moon, which, in the year 565, for example, was of 6 digits, was in the year 583 of 7 digits, and in 601 nearly 8. In 908 the eclips became total, and it remained so for about twelve periods, or until the year 1088; this eclipse continued to diminish until the commencement of the fifteenth century, when it totally disappeared in the year 1413. In like manner an eclipse of the sun, which first appeared at the North Pole in June 1295, proceeded more southerly at each period. On the 27th August, 1367, it made its first appearance in the north of Europe; in 1439 it was visible all over Europe; in 1601, which was its nineteenth appearance, it was central in London; in 1818, on the 5th of May, it was visible in London, and was again nearly central in the same place on the 15th May, 1836. At its thirty-ninth appearance, August 10th, 1980, the moon's shadow will have passed the equator, and as the eclipse will take place nearly at midnight, it will be invisible in Europe, Africa, and Asia. At every subsequent period the eclipse will go more and more towards the south, until, finally, on the 30th September, 2665, which will be its seventy-eighth appearance, it will go off at the south pole of the earth, and disappear altogether.

## MISCELLANIES.

*Construction of Railways.*—At a late meeting of the institutions of Civil Engineers a conversation took place on the paper that had been read by Mr. Reynolds, at a previous Meeting on the form of rails and method of constructing Raiways. It was stated that there were evidently great advantages in the system of continuous bearing; and the combination of wood and iron, proposed by Mr. Reynolds, seemed well adapted in some respects to answer the proposed object. But a question might be raised respeating the angu-

lar form of the bearers. There were advantages in the facility with which the under sides of these bearers might have earth beaten under them, so as to restore any part which might have sunk; but the peculiar advantages assigned to this form, as affording the vertical support due to an encreased area, were not at once apparent. To this it was replied, that the rails on Chatmoss did not show and tendency to sink, and were, in the opinion of many who had been to see them, in a better condition, both as to level and wear, than the others which had been laid at the same time in the usual manner. Objections to the wood, from its liability to decay, were replied to, by stating that the wood having been boiled in tar, and allowed to cool in the tar, became impervious to moisture, and was, consequently, very little liable to decay.

*Products of American Forests.*—The value of skins, furs, ginseng, lumber, staves, bark, tar, pitch, rosin, and turpentine, and pot and pearl ashes, partly from the northern and partly from the southern states, which were formerly of much greater comparative importance in the trade of the country, now constitutes about one-thirteenth part of the whole value of the domestic exports, and amounts to 3,889,611 dollars. A large proportion of the trade in these articles, as well as in those of cod-fish and bread-stuffs, is carried on with the West Indies, Mexico, and South America. The skins and the furs go to Europe and Canton; the ginseng to Canton, but in less quantity than formerly, being, in 1828, but 91,164 dollars; and the pot and pearl ashes are sent to England and France.

*Products of the American Sea.*—The products of the whale, cod, mackerel, and herring fisheries, exported mostly from the northern states, amount to 1,693,980 dollars, being nearly a thirtieth part of the whole domestic export. Nearly one-half of this value consists of cod-fish, and more than one-third of the products of the whale fisheries.

## INSTITUTIONS.

LECTURES DURING THE WEEK.

*London Institution.* Finsbury Circus.—Monday, May 1, at 7 o'clock, H. Innes, esq., on the Sacred Poetry of Great Britain.

*London Mechanics' Institution,* Southampton-buildings, Chancery-lane.—Wednesday, May 3, at half-past eight, Mr. Cull, on Phrenology. —Friday, 5, Dr. Ritchie, on Optical Instruments. &c.

*Aldersgate-street Institution*—Wednesday, May 3. at eight, R. Addams, esq., on Dynamics.

*Western Literary and Scientific Institution,* 47, Leicester-square.—Thursday, May 4, at half-past eight, Mr. Stanhart, on Lithography.

*Eastern Athenæum,* Stepney Square.—Wednesday, May 3, at eight, N. F. Zaba, esq., on the Literature of Poland.

*Lambeth Literary and Scientific Institution.*—Tuesday, May 2, at half-past eight, W. Luking, esq., on Cometary Astronomy.

*Southwark Literary Society.*—Wednesday, May 3, F. Statham, esq., on Optics, at eight.

*Poplar Institution,* East India Road.—Tuesday, May 2, at eight, W. Chalklen, esq., on Roman History.

*Tower Street.*—Monday, May 1, at eight, Mr. Thomas, on the Origin and Progress of the Art of Printing.

*Bermondsey Mutual Instruction Society.*—Tuesday, May 2, at quarter past eight, Mr. H. W. Saffel, on Chemistry.

*Finsbury Mutual Instruction Society.*—Tuesday, May 2, at half past eight, Mr. White, on Hydrostatics.

## TO CORRESPONDENTS.

*To the Editor of the Penny Mechanic.*

*Contraction of Burnt Clay.*—Sir, In answer to your Correspondent who wishes to know the reason of clay contracting instead of expanding by heat, I would suggest that as clay is a powerful absorbent of moisture, and also that it is extremely difficult o deprive it of the moisture once imbibed, it is *probable* that the contraction is caused by the volatilization of the liquid. This assertion seems to be borne out by the fact, that on cooling it remains contracted, instead of returning to its former volume. If you think this is worthy of insertion in your valuable journal, you will oblige.—China.

*Quill Making.*—Sir, if a description of the process termed "Dutching," which I think is the first a quill is subject to, will aid your Correspondent "C. D." in his inquiry, I will forward an illustration; but if he alludes to the yellow colour that quills are made to assume; that is effected by holding them for some time in boiling Linseed Oil.—W. Clements.

"M. N." We will insert his communication if he will send us a description of the action of the Paddle Wheel, and a clearer drawing.

"W. L. T. of Birmingham," can ascertain "the temperature of the earth at various depths below its surface in any latitude," by means of a thermometer. In latitude 22° he will find an uniform temperature a few feet below the surface: the same at other places.

"John Gregory." We are much obliged for the additional particulars and the drawing. We will not forget his request.

"F. R. I. A." Address "to the Secretary at the Southampton Coffee House, Southampton Buildings, Chancery Lane.

"W. J. B." should write to "the Doctor."

"Mr. Monday's" Safety Lamp shall be noticed in an early Number.

We shall be glad to receive a description of the process of Quill Making from Mr. Clements.

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# THE PENNY MECHANIC.

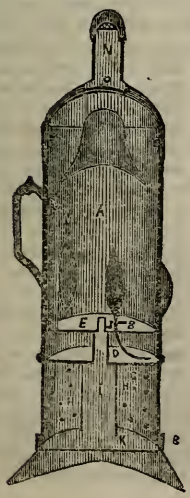
A MAGAZINE OF THE ARTS AND SCIENCES.

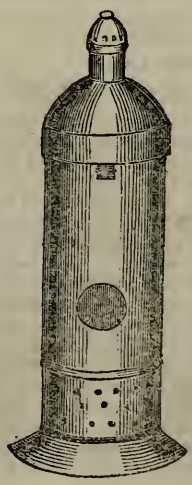
No. XXVIII.] SATURDAY, MAY 6, 1837. Vol. I.

THE ROYAL MONGOLFIER.

THE SAFETY LAMP.

Fig. 1. Fig. 2.







Holloway Press: D. A. Doudney

## THE ROYAL MONGOLFIER.

*Celebration of the* PRINCESS VICTORIA'S *Birth-Day.*

THE 24th of the present month being the day appointed for the celebration of the termination of the Princess Victoria's minority; and, as it will be a general festival, we think we cannot acquaint our juvenile readers with a more pleasing mode of signifying their gratification at the important event, than by directing their attention to the Mongolfiers, or, Fire Balloons—of which, and the mode of inflation, we have given a sketch in our front page.

These balloons are constructed (from 7 to 25 feet in circumference) of various tinted tissue paper, with the word "VICTORIA" in large characters, and the Royal Arms, on different parts of them. They are inflated by means of a proportionate quantity of cotton attached to the orifice, which being saturated with spirits of wine, and ignited, causes the balloon to ascend, and remaining sometime in the air, affords a most interesting exhibition. The wrapper of each balloon contains a few familiar observations on the Arts and Sciences, adapted to the capacity of youth, which it would be well to commit to memory previous to the ascent of the Mongolfier; thus combining utility with amusement. To parents it will afford an opportunity of dictating a pleasing lesson, with the promise of an interesting reward.

A still evening, about sunset, is the best time for the display. The above may be obtained of Darton and Son, Holborn Hill, and most respectable Booksellers and Toymen.

## SAFTEY LAMP.

*To the Editor of the Penny Mechanic.*

SIR,—The following is a description of a Safety Lamp, for the use of persons working in coal mines, &c., which may be of service to some of your numerous readers, fig. 1, is a section of the whole, *a* is the interior of the lantern, *b* the lamp, *c* the burner which must be nearly in the centre, *d*, a piece of tube soldered in the lamp as near as possible to the burner to receive the smaller tube, *e*, which is soldered to the partition that supports the lamp, which is marked, *g*, *h h*, is a large tube also fastened to the partition, *i* is the interior of the tube filled with pieces of wire of one-eighth or three-sixteenths of an inch in thickness, pointed at each end, *k* is the bottom which must be made to open at *l*, to enable the wires to be cleaned if required, *m* is a handle fixed to the lamp for the purpose of removing it when it requires trimming, attached to which is a reflector, and in the front is a lens for making the light more powerful, *n* is the top of the lantern, in the centre of which is a tube filled with wire the same as the bottom, the lower ends resting on the circular piece of metal *o*, the top being covered by a cap having holes round the outside. Now it will be seen that to supply this lamp with fresh air, it must enter the lantern through the holes in the outside, pass under the tube and between the wires, and through the small tube, the upper end being close to the flame, the air will be consumed (whether inflammable or not) immediately on entering; the burnt air passing out at the top between the wires as on entering. Fig. 2 is the outside of the same. If, Sir, you consider this worth you notice, the insertion will oblige

Your obedient Servant,
F. MONDAY.

## UNHEALTHY TRADES.

[THE Editor of the "American Journal of the Franklin Institute" a short time back published the following interesting paper on this subject, in answer to the question "are there any trades so injurious to health, or so hazardous to morals, that they ought, for that reason, to be discouraged or abandoned?" Few persons, perhaps, will be disposed to dispute the conclusion at which he arrives, although we think it by no means necessary, in order to secure the comforts and luxuires we now enjoy, that so many of our fellow creatures should be compelled to pass a miserable and painful life, and die generally long before the ordinary time of other men. Therefore, although we agree with the writer that the comforts of the majority ought always to receive consideration before those of the minority, yet we see no reason whatever why the minority should be obliged to undergo all kinds of privation in order to secure the enjoyments of the other portion of society. In the cases referred to, there is every probability that in a few years time machinery will be constructed that will obviate the necessity of men, like the needle pointers, for instance, undertaking a business the pernicious effects of which are so well described by the writer. And when we know what has already been done for the miner, by the invention of the safety-lamp, we have every reason to hope that the perils to which he is now unfortunately so often still exposed, may

be provided against, if not entirely removed. The same effect we trust will be produced by machinery in the various other trades that are now so injurious to health, and so destructive of human life.]

When the question, "Are there any Trades so Injurious to Health, or so hazardous to Morals, that they ought, for that reason, to be discouraged or abandoned?" is propounded to an individual whose mind has not been schooled by habits of reflection, and there is presented to his notice some occupation or trade which is obviously injurious to health, or hazardous to morals, he will probably pronounce, at once, that it ought to be abolished by the interposition of the law. The philosopher and the moralist, however, who are in the habit not only of inquiring into the immediate relationships of every subject, but of tracing each to its remote affinities, will, in most cases, see cause to reverse this judgment. The question before us, will, I apprehend, be found, in most of its bearings, to be one of a very complex character. This must be apparent, when it is recollected, that the perfection of those arts from which civilized man derives so many of his highest intellectual and corporeal enjoyments, are dependent upon pursuits which form very remote links in the chain of events upon which civilization itself is dependent; events, however, so intimately catenated, that we may with much reason apply to them the idea of the poet, that if the connection is destroyed,

"Whichever link you strike,
Tenth, or ten-thousandth, breaks the chain alike."

The question, as propounded, is so latitudinarian in its terms, as to render it impossible, in the compass of such a report as ought to be delivered to the Lyceum, to present it in many of its bearings. I shall, consequently, be compelled to assign to it limits of my own choosing; although in so doing, I may be charged with acting something like the Grecian, who, having a house for sale, exhibited a single brick as a sample of its elegance and convenience.

The proportion of those trades and occupations which are unfavourable to health or hazardous to morals, is very large, when compared with the whole catalogue of those pursued by man. Some of these are intrinsically hurtful in both respects, whilst others are rendered so, principally, or entirely by the manner in which they are carried on, and the habits of those engaged in them. It seems necessary, however, to confine our inquiry to such as are intrinsically hurtful, as in the others, it is the habits which are to be condemned, and all will admit that these, when bad, ought to be discouraged and abandoned.

I have already remarked that the terms of the question are somewhat vague. I allude particularly to the words "discouraged or abandoned." If regulation or suppression is intended, this will refer the action to the legislative and executive authorities, and in this way I consider it as necessary to treat it; for if such things are to be attempted by individual exertions, the whole business of the world must merge in the formation of a thousand different societies, analogous in their organization and objects with that of the Temperance Society.

The business of the miner is, in numerous instances, extremely unfavourable to health, and that necessarily so; in proof of this position we will take an example from the mines of a common metal,—lead, in a place chosen at random, where there is nothing to render the business particularly hurtful. In a work written within a year or two, it is observed by its author, Mr. Thackrah, that at the small village of Arkendale, situated in a mining district in Yorkshire, England, there were then not fewer than thirty widows under thirty years of age, whose husbands had died of diseases of the lungs and other affections, brought on by the dampness of the mines, and the other hurtful circumstances attendant on the business in which they were engaged. Where there is so much early destruction of life, we must necessarily conclude, that a large proportion of those whose constitutions enable them to resist the fatal effects of their business for a longer period, must drag out existence in a state of extreme suffering. The picture of the suffering in these mines, however, would lose its colouring alongside those which might be drawn of that endured in the mines of quicksilver in Idria, of arsenic and cobalt in Germany, and of many, very many others in different countries. Were I to describe them, I must place before you such scenes of human suffering, as it would be extremely painful to narrate and to hear; I forbear, therefore, to bring them forward, not deeming them necessary to the sustaining of the position which it is my design to advocate.

Shall we pass laws for the purpose of preserving the health, and of saving the lives of those now employed in these mines? If so, we must ordain that they shall be closed up, and that the metals which they produce shall be no more used

in the arts. Let us suppose that quicksilver, one among the worst, was selected, and that the use of that metal alone was inhibited. What would then become of those mines of gold from which the precious metal cannot be obtained in any other way than by its amalgamation with mercury? All the arts which are dependant on the use of this metal, must be relinquished, and of these there are several of no small importance, and the relinquishment of which would involve very serious considerations. It may be doubted whether the ladies themselves, humane as they are, would ever consent to forego the employment of those ornamental and useful mirrors by which their charms are so often and so faithfully reflected. Admitting, however, that this sacrifice was made, and for the looking glass we had substituted plates of polished metal, or in default of these, the mirror of Narcissus, there would still remain unfulfilled the most important purpose to which quicksilver is now applied. Because thousands perish in the working of these mines, shall we, to save these, indirectly slay our tens of thousands, by depriving the physician of the use of that Sampson of medicine, mercury? A remedy, without which, his efforts to cure some of the most formidable diseases, would be altogether unavailing. Were I to pursue this part of our subject to its limits, I believe that, standing alone, it would suffice to convince any one of the utter futility of the attempt to legislate respecting, or in any other way to regulate, the pursuit of such a business as even that of digging for quicksilver.

Leaving one of the worst, we will inquire for a few minutes into some of the consequences resulting from our obtaining from the earth those substances which are among the most harmless, and the most useful productions of the mineral kingdom. Were we to visit the coal districts of England, we should find them abounding with widows and orphans, whose husbands and fathers have been blown to atoms, or scorched to death, by the explosions of the fire damps, a hundred at a time; or who have been killed by the choke damp, or drowned in the waters which sometimes make an irruption into these mines. We should, also, every where, meet the lame, and the halt, and the blind, who have merely escaped from a sudden death to drag out a miserable existenco in pain, poverty, and want of every description. Shall we apply a remedy to these evils, and provide that, in the coal mines, there shall be no more accidents from carburetted hydrogen, carbonic acid, water, the falling in of roofs, or the giving way of ropes, chains, and ladders? But how shall we accomplish this? Why certainly in one way only; we must resolve to do without the coals; we must close the smelting furnaces of a nation; arrest every branch of manufacture, and at length put a final end to human misery, by allowing, in the first winter, the poor and the rich to freeze to death in one common mass, from the want of the only fuel which the country can supply.

The universal suffrage, I apprehend, would be against such a measure; at all events, when the toes and the fingers of those who sublimated, sentimental humanity had caused them to hesitate, were becoming frost-bitten, they would send in their adhesion, and admit that it would be best to let the colliers pursue their labours, and run their inevitable risks.

*(We will conclude the paper next week.)*

## THE STEAM ENGINE.

### NO. VIII.

The Atmospheric Engine, described in Number 23, possessed several very great advantages over that of Savery's. It was not dangerous to use. The low pressure of the steam employed to work it rendered the bursting of the boiler almost an impossibility, except those who had to superintend the engine were very careless. Savery's engine on the contrary was always dangerous. The high pressure of the steam used, required the boilers to be exceedingly strong in order to prevent their bursting; and in consequence of the great heat required to produce steam of the necessary power, the engines were constantly out of repair. This was not the case with the atmospheric engine; and consequently they were much less expensive than Savery's, and far preferable. But the principal advantage of Newcomen's improvement was, that the working beam enabled the power of the engine to be applied to any kind of machinery; and to the generation of power there was no limit but the dimensions of the cylinder, and consequent diameter of the piston. It might from these circumstances be imagined that Newcomen and Cawley would at once have received the patronage their ingenuity deserved. But the patentees had many difficulties to overcome. We have before mentioned that they were not men of science. They were not mathematicians, and the want of knowledge of this kind prevented them taking that advantage of their invention that they would otherwise have been ena-

bled to do. "In 1711, the patentees made proposals to draw water from a mine at Griff in Warwickshire; but their scheme did not meet with any encouragement. In March 1712, through the acquaintance of a Mr. Potter, of Bromsgrove, in Worcestershire, Newcomen succeeded in getting a contract to draw water for a Mr. Back, of Wolverhampton, and being near Birmingham, Newcomen obtained the assistance of many ingenious mechanics of that place, who greatly improved the working of the engine.

The usefulness of the atmospheric engine depended on the rapidity with which the steam that was admitted into the cylinder to force up the piston, could be condensed. As in order to produce this effect it was always necessary to cool down the whole cylinder to a temperature below that of steam, it is evident that there must necessarily have been a great loss of time and fuel. For the steam could not be condensed quickly; not more than seven or eight strokes a minute could be made; after each condensation it was also necessary to raise the cylinder to the same temperature as the steam, before an effective stroke could be obtained. A means of remedying these evils to a great extent was discovered by accident. The piston rod was one day observed to make several strokes in succession with very great rapidity, and without the usual process of cooling the cylinder. Newcomen could not at first account for this, but on closely examining the cylinder, a small hole in it was discovered, through which it was found a jet of cold water had been injected into the interior. This at once condensed the steam, without materially reducing the temperature of the cylinder, and in a much shorter time than was required by the ordinary method of producing that effect. Newcomen took advantage of the hint thus afforded him, and immediately altered the machinery of the engine, so that instead of cold water being allowed to fill the space between the two cylinders, as represented in the engraving in Number 23, the water was injected into the interior of the steam cylinder.

The manner in which the engine worked when thus altered was as follows. Steam having been generated in the boiler, below the cylinder, was admitted into it through a connecting pipe. The force of the steam drove up the piston, and a cock was then opened which allowed water from a cistern above the cylinder, to issue from a pipe in the form of a jet; this condensed the steam in the cylinder into water, and produced a vacuum. The atmosphere pressing with a force of nearly 15 lbs. on every square inch of the piston accordingly drove it down, with a force proportionate to its diameter. The larger the piston, of course the greater was the power generated by this means.

Although the steam-engine thus constructed was greatly superior to any that had previously been invented, there were many serious inconveniences attending its working. Persons were obliged to be in constant attendance to open and shut the cocks of the injection pipe, and unless this was effected at the proper time, the machinery might be severely injured. As however the operation was purely mechanical, and only required proper attention, it was generally intrusted to boys. One of these, who without any good reason, has generally been spoken of as a very idle fellow, and blamed for his indolence, rather than applauded for his ingenuity, contrived a means by which the engine should open and shut the cocks itself. He added a catch, or scoggan, as he called it, to the cocks, and the piston in rising and falling opened and shut the cocks by this means at the exact moment required. Humphrey Potter, who is not known for having made any other invention in mechanics, has had his name preserved to posterity for this. Although idleness is generally asserted to have been the cause of his exerting his ingenuity to so useful a purpose, it is rather unfair to assume this, when the merit of his invention, and consequently his ingenuity, is really considered. From the regularity and certainty with which the steam could now be condensed, the engine that previously could not make more than seven or eight strokes a minute, was enabled to make fifteen or sixteen.

The contrivance of Humphrey Potter directed the attention of an ingenious engineer to the subject. In 1718 Mr. Henry Beighton erected an engine, in which all the cocks were opened and shut by a piece of mechanism called by him "hand gear;" a rod, suspended from the beam of the engine, had a number of pins projecting from it, which acted upon a number of levers, and thus effected what had previously been accomplished by hand, or by Potter's contrivance. By these means the steam-engine was brought to a state of comparative perfection, and with some few improvements that were made in the hand gear; and also in the construction of the other parts of the machinery by Smeaton, it was in this state that the great James Watt found it, when his attention was first directed to the subject.

## BIOGRAPHICAL SKETCHES.

### JAMES BRINDLEY.

*(Concluded from page 213.)*

The most experienced engineers, upon former systems, were amazed and confounded at his projects of aqueduct bridges over navigable rivers, mounds across deep valleys, and subterraneous tunnels; nor could they believe in the practicability of some of these schemes, till they saw them effected. Nothing can resist true genius. Irresistible must have been that of him whose "ideas," while in the execution of these things, are allowed to have been "all his own;" and when the minutest, as well as the greatest of the expedients he employed, bore the stamp of originality.

His whole time was engrossed in devising means for advancing the inland commerce of his country, by projecting and perfecting those more modern rivers which are generally known under the designation of canals; an occupation so exclusively interesting to him, that when he was asked before a committee of the House of Commons, having thrown out some contemptuous observations respecting the worth of rivers, what he conceived they were created for? he immediately answered—"To feed navigable canals." Nothing could more aptly have characterised the genius of Brindley.

After the successful execution of the Duke of Bridgewater's Canal to the Mersey, Mr. Brindley was employed in the revived project of carrying a canal from that river to the Trent, through the counties of Chester and Stafford.

During the progress of this undertaking which was begun in the year 1766, he was called upon to exert all the resources of his genius, particularly as to the hill of Hare-Castle, which was only to be passed by a tunnel of great length, bored through strata of different consistency, and some of them mere quicksand. Whilst this canal was forwarding, its conductor was entrusted with the superintendence of a canal from the Grand Trunk, near Haywood, in Staffordshire, to the river Severn, near Bewdley; which was finished in 1772, and by means of which the port of Bristol obtained a communication with Liverpool. Indeed, there was scarcely any design on the subject of canal navigation, towards the close of his career, on which he was not consulted, and the plan of which he did not either entirely form, or, at least, revise and improve. At length however he fell into a kind of chronic fever, which, continuing some years with but little intermission, finally terminated his life, September the 27th, 1772, in the 56th year of his age.

Brindley is described, "in appearance and manners, as well as acquirements, to have been a mere peasant. Unlettered, and rude in speech, it was easier for him to devise means for executing a design than to communicate his ideas concerning it to others. His ideas were his own. Not having those of other men to assist him, whenever a point of difficulty in contrivance occurred, it was his custom to retire to his bed, where, in perfect solitude, he would lie, one, two, or three days, pondering the subject in his mind, till the requisite expedient had presented itself. This is that true inspiration which men of original genius, in every walk, are actuated by, when, from the operation of the mind, acting upon itself, without the intrusion of foreign notions, they create and invent. Originality like his, however, had its disadvantages. Accordingly, in his calculations of the powers of machines he followed a plan peculiar to himself; but, indeed, the only one he could follow without instruction in the rules of art. He would work the question sometimes in his head, and then set down the result in figures; then taking it up in this stage, he would proceed by a mental operation to another result; and thus he would go on by stages, till the whole was finished, making use of figures only to mark the several results of his operations. But though, by the wonderful powers of native genius, he was thus enabled to get over his want of artificial method to a certain degree; yet there is no doubt that, when his concerns became extremely complicated, with accounts of various kinds to keep, and calculations of all sorts to form, he could not avoid that perplexity and embarrassment which a readiness in the processes carried on by pen and paper can alone obviate. His estimates of expenses have generally proved wide of reality; and he seems to have been better qualified to have been the contriver than the manager of a great design. Though defective in such respects, a remarkably retentive memory was one of the essential qualities which Mr. Brindley brought to his mental operations. This enabled him to execute all the parts of the most complex machine in due order, without any help of models or drawings, provided he had once settled the whole plan in his mind.

## MECHANICS' LIBRARY.

*The Engineers' and Mechanics' Encyclopædia.* By Luke Hebert, C. E. Kelly.

THE plan of this work is exceedingly good,

and the class of persons for whom it is more particularly intended will find it a useful assistant in their different professions. This Encyclopædia is not, however, of an exclusive character; it is an epitome of practical science, and will amuse and instruct those who may not require for their business the information it contains as well as those who do. The articles are very clearly written, and will be as easily understood by the "mechanic" as by the "engineer." Indeed, we are not acquainted with a work which, on the whole, we would sooner recommend to the notice of our readers for a lucid explanation of the useful arts than "the Engineers' and Mechanics' Encyclopædia." From its title, we anticipated that it would be more technical than it is; and its not being so may, by some persons perhaps, be considered a fault. It may be thought that it is written too much for the general reader. From a careful examination of the work, we are, however, inclined to think that the grounds for such a charge are more apparent than real. The tables contained in the work will be found of much service by the practical man; and the articles on railways, clock and watch-making, printing, gas-lighting, and the steam-engine; and also most of those on the different branches of manufacture and the arts, while they cannot fail to interest the general reader, at the same time contain much valuable information that will prove especially useful to the workman. A greater space might have been advantageously allowed for some of the articles connected with chemical science. We wish the paper on chimistry itself had been longer; what is said, however, is very well said. The descriptions of the processes of brewing and dyeing deserve particular notice; and the papers on the silk and cotton manufactures contain much curious detail. The work is very neatly printed, and there is a profusion of wood-cut illustrations, which greatly enhance the value of all books, but more particularly such as the present.

## THE STEAM PLOUGH.

*To the Editor of the Penny Mechanic.*

Sir,—In Number 22, of your useful little miscellany, a paragraph appeared stating that the Highland and Agricultural Society of Scotland, had offered a premium of £500 for the first successful application of steam power to the cultivation of the soil, and also that from that circumstance you presumed the steam plough invented by Mr. Heachcoat, M. P., had not proved successful. A few days ago an article was published in the newspapers, giving an account of the exhibition of the powers of the plough before a deputation of the society above mentioned; but it does not state whether or not the deputation were satisfied with it. When the plough was first exhibited in June, last year, there appeared to be scarcely a doubt of its complete applicability to agricultural purposes. Perhaps you, or one of your correspondents, can give a satisfactory answer, and oblige

Sir, Yours, &c.

J. F. S.

## EXPLOSIONS OF GAS.

Accidents of this kind were at one time more frequent than they are at present, but now they occur much oftener than many persons suppose. The following directions how to act whenever an escape of gas from any of the pipes is discovered, may not therefore be without use.

When a strong smell of gas is perceived, a leaking from some cause must have taken place; and every door and window in the room which may contain it, should be opened, that the mixture of gas and atmospheric air may escape. Neither lighted candle nor any other inflamed substance should be introduced, or allowed to approach the place, until the whole of the mixture of common air and gas is completely expelled, and the room thoroughly ventilated.—It cannot be too strongly impressed upon every person who is in the practice of using gas-lights, that the gas is not explosive of itself, in the state the public receive it from the gas works; and to render it capable of exploding, it requires to be mixed in various proportions of from five portions of coal gas to twelve of atmospheric air; and when mixed in any of these proportions, it will not explode unless flame come into contact with it. Oil-gas is rendered explosive when mixed with about three and a half or four parts of common air, and its explosive property increases till the mixture arrives at about nine or ten parts of atmospheric air, which is generally its highest point; but as the atmospheric air mixes with it in larger quantities, the explosive power gradually becomes less, till it totally ceases. Whenever, therefore, any escape of the gas may be discovered to have taken place, the proper recourse is ventilation without delay, and preventing the introduction of a lighted candle or any other kind of flame where the circumstance may occur. Proper ventilation, and keeping away flame, will infallibly tend to prevent ac-

cidents from explosion. These are facts which every one should know, and then he may use gas-lights not only without apprehension, but with the most perfect satisfaction.

## MISCELLANIES.

*Decay in Timber.*—At a meeting of the Institute of civil Engineers held 14th March last, some remarks having been made on the decay of Timber in contact with Stone, it was stated by a member that he had recently examined a bridge, the only decayed parts of which were those built into the stone. That the ends of the timber being charred, or placed in an iron socket, however thin, was a certain preservative; but that wood in contact with stone invariably decays in a very short time. A member stated, that in a situation with which he was acquainted, the wood near the ground was seized by the dry rot in a very short time. This was prevented by inserting the door-posts, &c. into iron boots sixteen or eighteen inches deep. It was suggested that the system of fronting, by which wood is surrounded with large quantities of moisture, must contribute to the early decay of bond timber, and that bond iron was consequently much used. This was said not to be the case in the buildings at Manchester; and the exception was attributed to the high temperature and consequent dry state at which the buildings are there maintained. The average temperature of the manufactories was stated to be sixty degrees Fah. Some remarks were then made on the system of building which was adopted at Manchester.

*Polishing Powder.* — Certain of the French manufacturers of polishing powder use in their manufacture scraps of old iron, which they put into a tub and cause to rust quickly by sprinkling with water. When a sufficient quantity of rust has thus been formed, it is collected by washing, and after allowing it to settle, it is dried and calcined in a crucible. The longer the calcination is continued, the more the oxide approaches to a violet hue, and the harder its grain. At a very high temperature the oxide is partly reduced, its colour becomes more gray, and the grain is too hard for polishing. The red oxide serves for polishing gold and silver, the violet oxide is fit for polishing steel. When taken out of the crucible it is first triturated, and then levigated, in order to collect the finest parts.

## INSTITUTIONS.

LECTURES DURING THE WEEK.

*London Mechanics' Institution*, Southampton buildings, Chancery-lane. — Wednesday, May 10, Mr. Brown on the Love of Praise.—Friday, 12th, Mr. T. Phillips, on National Melodies, both at half-past eight.

*Aldersgate-street Insitution.*—Wednesday, May 10, R, Adams, esq., on Dynamics, at eight.

*Western Literary and Scientific Institution*, 47, Leicester-square.—Thursday, May 11, at half-past eight, Mr. Fry, on the Character and Writings of Milton.

*Lambeth Literary and Scientific Institution*, Waterloo Bridge road.—Tuesday, May 9, at half-past eight, W. Lukeing, esq., on Light and Colour.

*Poplar Institution*, East India Road—Tuesday, May 9, at eight, William Chalklen, esq., on Roman History.

*Society of Arts*, Adelphi.—Monday, May 8, at eight, J. Hemming, esq., on the Art of Embossing Paper.

*Eastern Literary and Scientific Institution*, 88, Hackney-road,—Tuesday, May 9, at eight, H. Innes, esq., on English Literature.

*Mutual Instruction Society*, Great Tower-street.—Monday, May 8, at eight o'clock, Mr. D. Saull, esq., on Geology.

*Kentish Town Mutual Instruction Society.*—Monday, May 8, at half-past eight, J. T. Hawkins, esq., on the Production of Wealth.

*Bermondsey Mutual Instruction Society.*—Monday, May 8, at a quarter-past eight, Mr. Saffell, on Chimistry.

*Finsbury Mutual Instruction Society.*—Tuesday, May 9, at half-past eight, Mr. White, on Hydrostatics.

### TO CORRESPONDENTS.

"A. B." and his friends shall have their wish attended to.

"Snubby Gong's" humourous epistle has come to hand. We shall be glad to receive some effusion of his wit of a more *scientific* character.

"C. Rolt." We cannot promise to insert the article sent us, but we are much obliged for it, and the drawing, although gasometers of a similar description were invented many years since.

"A Mechanic," may probably obtain a pecuniary reward for his ingenuity by sending his model or drawing, and a description of it, to the Society of Arts, Adelphi.

"H. Bardsley" who wishes to know "the cost and manner of taking out a Patent," will find some information on the subject in our back Numbers. It will be necessary for him to employ an attorney.

"Mr. J. Gregory's" drawing of an Improved Balloon and the description shall appear if possible next week.

Received "D. M." "X. X." "A Young Mechanic," and "Sophos."

"An Old Reader," who complains that our type is, *now* almost too small for him to read conveniently, ought to patronize a spectacle maker.

Several Queries next week.

London: Printed at the Holloway Press, by D. A. Doudney; published by Berger, Holywell-street, Strand; and may be had of all Booksellers.

# THE PENNY MECHANIC.

A MAGAZINE OF THE ARTS AND SCIENCES.

No. XXIX.] SATURDAY, MAY 13, 1837. Vol. I.

## IMPROVED BALLOON.

Fig. 1.

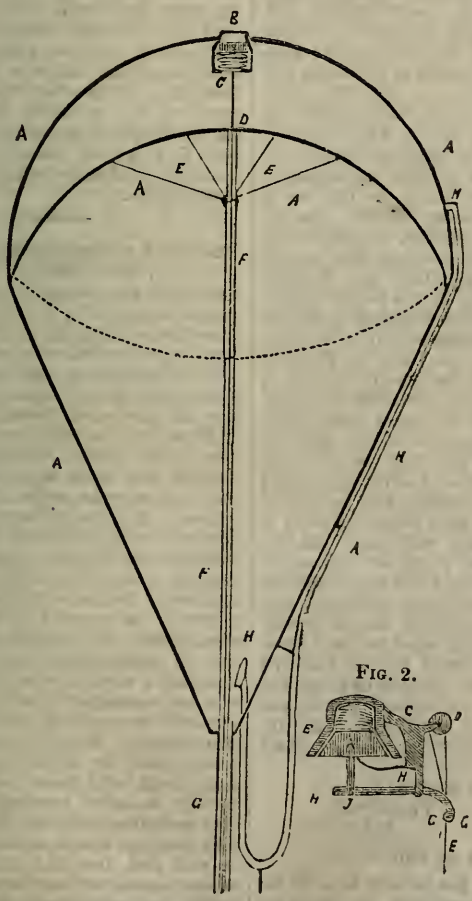



Fig. 2.






Holloway Press: D. A. Doudney.

## IMPROVED BALLOON.

*To the Editor of the* PENNY MECHANIC.

SIR,—No doubt your readers are quite aware that the expansion of gas in balloons is owing to the decreased pressure of the atmosphere; for my part I cannot see the least utility for ascending so high but just merely to gratify curiosity, for no benefit can arise from it, but great inconvenience, if aerostation is ever applied to a useful purpose, which I feel confident it can by the application of my invention described in Number 11 of the PENNY MECHANIC. Nothing would be more distant from the aeronaut's thoughts than that of ascending to a great altitude with the exception of getting above a storm or contrary wind, under circumstances which cannot be avoided at all times, and though you may keep as near the earth as possible, still your gas will expand; to prevent this in a measure, if not entirely, I propose to use artificial pressure; see fig. 1. The action of this arrangement will be as follows, when the balloon is inflated it will be as represented; gas occupying the whole interior. Upon finding the gas expand, the aeronaut has only to draw down the partition A, A, thereby condensing the gas in the lower department, at the same time allowing space for expansion in the upper: if that expands too much you open the valve by the cord *d*, passing through the pipe *f f*, which is used as a rope to draw down the partition. But to prevent, on the other hand, your condensing the gas too much, and the danger of bursting this is obviated by the pipe *g*, being introduced at the orifice and passed under two inches and a half of water, thus acting as a safety-valve in a boiler; for your silk will bear 162 lbs. pressure per square yard, and you counterpoise that by using three and a quarter inches of water, so by only using two and a half inches, bursting is almost impossible. When it does blow off you have only to open a stop-cock fixed in the pipe *h*, *h*, *h*, *h*, in the car, and thus allow the gas to fill the upper department of the balloon. If this is worthy of being inserted in your interesting work, I shall feel obliged.

I am, Sir,
Yours truly,
J. GREGORY.

### EXPLANATION OF ENGRAVING.

Fig. 1, *a*, *a*, *a*, *a*, the balloon A, A, an internal partition composed of Mackintosh's cloth, fixed firmly to the exterior covering, B is the valve, *b* is the valve plug, ground in its seat air tight, and kept in its place by the spiral spring, *c d* is the cord which opens the valve, and which passes through the leathern pipe *f f*, and the cord passes the end of the pipe, *g* and dips three and a half inches under water, which would equal the condensation of 162 lbs. per square yard, and thus act as a safety-valve, *h*, *h*, *h*, *h* is a leathern pipe coming from above the partition A A, passing down the exterior of the balloon into the car, where there is a valve inserted, and into the lower part of the balloon as represented.

Fig. 2, is another discription of valve of which a vertical section is given, *a* is the valve plug, *b* the valve, *c* a stay to which the pulley *d* is fixed, also the steel-yard *g g*, to which the cord *e* is fastened and passed over the pulley, by pulling which cord the valve is opened, *f* a rod from the plug to which the steel-yard is attached, *h* is a strong spring pressing the valve-plug in its place, the axis of the yard is at *g*; no doubt your numerous readers will clearly understand the action of this valve.

## PECULIAR PHENOMENON CONNECTED WITH RESPIRATION.

AT one of the scientific meetings at the apartments of His Royal Highness the President of the Royal Society, whilst speaking of certain men, who, by means of peculiar apparatus for breathing, could walk about at the bottom of waters, and also of the pearl fishers; Sir Graves C. Haughton described to me an observation he had made, by the application of which a man could hold his breath about twice as long as under ordinary circumstances. It is as follows:—If a person inspire deeply, he will be able immediately after to hold breath for a time, varying with his health, and also very much with the state of exertion or repose in which he may be at the instant. A man, during an active walk, may not be able to cease from breathing for more than half a minute, who, after a period of rest on a chair or in bed, may refrain for a minute or a minute and a half, or even two minutes. But if that person will prepare himself by breathing in a manner deep, hard, and quick (as he would naturally do after running), and ceasing that operation with his lungs full of air, then hold his breath as long as he is able, he will find, that the time during which he can remain without breathing, will be double, or even more than double the former, other circumstances being the same. I hope that I have here stated Sir Graves C. Haughton's communication to

me correctly; at all events, whilst confirming his observation by personal experience, I found the results to be as above.

Whilst thus preparing myself, I always find that certain feelings come on, resembling, in a slight degree, those produced by breathing a small dose of nitrous oxide; slight dizziness and confusion in the head are at last produced; but on ceasing to breathe, the feeling gradually goes off, no inconvenience results from it either at the time or afterwards, and I can hold my breath comfortably for a minute and a quarter, or a minute and a half, walking briskly about in the mean time.

Now this effect may be rendered exceedingly valuable. There are many occasions on which a person who can hold breath for a minute or two minutes, might save the life of another. If, in a brewer's fermenting vat, or an opened cesspool, one man sinks senseless and helpless, from breathing the unsuspected noxious atmosphere within, another man of cool mind, would, by means of this mode of preparation, which requires nothing but what is always at hand, have abundant time, in most cases, to descend by the ladder or the bucket, and rescue the sufferer without any risk on his own part. If a chamber were on fire, the difference in the help which could be given to any one within it by a person thus prepared, and another who goes in, perhaps, with lungs partially exhausted, and who, if he inhale any portion of the empyreumatic vapours of the atmosphere, is stimulated to inspire more rapidly, and is therefore urged to instant retreat into fresh air, is so great, that no one who has noticed what can be done in a minute or in two minutes of time, can doubt the value of the preparation under such circumstances, even though from want of practice, and from hurry and alarm, it may be very imperfectly made. In cases of drowning, also, a diver may find his powers of giving aid wonderfully increased by taking advantage of Sir Graves Haughton's fact.

I have myself had occasion to go more than once or twice into places with atmospheres rendered bad by carbonic acid, sulphuretted hydrogen, or combustion; and I feel how much I should have valued at such times the knowledge of the fact above stated. Hoping, therefore, that it may be useful, I will add one or two precautions to be borne in mind by those who desire to apply it.

Avoid all unnecessary action, for activity exhausts the air in the lungs of its vital principle more quickly, and charges it with bad matter. Go collectedly, coolly, and quietly to the spot where help is required; do no more than is needful, leaving what can be done by those who are in a safe atmosphere (as the hauling up of a senseless body, for example,) for them to do. Take the precautions usual in cases of danger, in addition to the one now recommended. Thus, in a case of choke-damp, as in a brewer's vat, hold the head as high as may be; in a case of fire in a room, keep it as low down as possible. If a rope is at hand, by all means let it be fastened to the person who is giving help, that he may be succoured if he should venture too far. It is astonishing how many deaths happen in succession in cesspools, and similar cases, for want of this precaution. It is hardly needful to say, do not try to breathe the air of the place where help is required. Yet many persons fall in consequence of forgetting this precaution. If the temptation to breathe be at all given way to, the necessity increases, and the helper himself is greatly endangered. Resist the tendency and retreat in time. Be careful to commence giving aid with the lungs full of air, not empty. It may seem folly to urge this precaution, but I have found so many persons, who, on trying the experiment on which the whole is based, have concluded the preparation by closing the mouth and nostrils after an expiration, that I am sure the precaution requires to be borne in mind.

I have thought it quite needless to refer to the manner in which the preparation enables a person to increase so considerably the time during which he may suspend the operation of breathing. It consists, of course, chiefly in laying up for the time, in the cells of the lungs, a store of that vital principle which is so essential to life. Those who are not aware of the state of the air in the lungs during ordinary respiration, and its great difference from that of the atmosphere, may obtain a clearer notion from the following experiment:—Fill a pint or quart jar with water over the pneumatic trough, and with a piece of tube and a forced expiration, throw the air from the lungs in their ordinary state into the jar; it will be found, that a lighted taper put into that air will be immediately extinguished.

A very curious fact connected with the time of holding the breath was observed by Mr. Brunel, jun., and has, I think, never been published. After the river had broken into the tunnel at Rotherhithe, Mr. Brunel descended with a companion (Mr. Gravatt, I think,) in a diving-bell, to examine the place: at the depth of about thirty feet of water, the bell touched

bottom of the river, and was over the hole, covering it, but too large to pass into it. Mr. Brunel, after attaching a rope to himself, inspired deeply, and sunk, or was lowered through the water, in the hole, that he might feel the frames with his feet, and gain further knowledge, if possible, of the nature of the leak. He remained so long beneath without giving any signal, that his companion, alarmed, drew him up before he desired; and then it was found, that either of them could remain about twice as long under water, going into it from the diving-bell at that depth, as they could under ordinary circumstances.

This was supposed to be accounted for, at the time, by the circumstance, that at the depth of thirty-feet, the atmosphere was of double pressure, and that the lungs, therefore, held twice as much air as they could do under common circumstances. It is, however, quite evident that another advantageous circumstance must have occurred, and that the air in the lungs was also better in quality than it would have been at the surface of the river, as well as denser; for supposing the deterioration by breathing to continue the same for the same time, it is clear, that every inspiration passed into the lungs twice as much pure air as would have entered under common circumstances: the injured air must, therefore, have been removed more rapidly, and the quality of that at any one time in the lungs must have risen in consequence. When to this is added the effect of double quantity, it fully accounts for the increased time of holding the breath; and had the effect of the mode of preparation now described been also added, it is probable that the time would have appeared astonishingly increased.—*Professor Faraday.*

## UNHEALTHY TRADES.

### SECOND ARTICLE.

Leaving the miners to those diseases and accidents to which their occupations necessarily subject them, because, for the purpose of continuing the blessings of civilization itself, we must obtain the metallic treasures of the earth, and the coal which is necessary to smelt them, let us make some inquiry into the effects of certain manufactures of the metals, after they have been brought into their regular state; in doing this, that one shall be chosen which does not possess any poisonous property, but which, in nearly all its combinations, is calculated to give tone to the animal system, whilst it, at the same time, forms the basis upon which the whole superstructure of the fine and useful arts is directly, or indirectly, sustained. This metal, you are all aware, is iron.

Without offering any great act of violence to the subject, we might, in speaking of this metal, introduce an inquiry into the remote effects of certain arts and trades; not upon the individuals who are the manufacturers of particular instruments, but upon those for, or against, whom, such are to be employed. The making of great, and of small guns, of pistols, of swords, in all their numerous varieties, of pikes, dirks, &c. &c. has, it is true, no remarkable injurious effects upon the persons who are thus employed, but, after they leave their hands, what myriads of the human race are cut off by them, whilst in the full possession of health, and in the prime of life. To such an inquiry, I am aware that it might be replied that nations and individuals will fight, and destroy each other, and that if deprived of the present more elegant means of doing so, they would still satisfy the noble calls of patriotism, the lust for spoil, and the promptings of ambition, by returning to the use of the sling, the bow, the war club, and the other rude modes adopted by our remote ancestors, and still pursued by impolite communities. Admitting this as an answer, it is much to be apprehended that one of a similar character, and equal in force, might be urged against any scheme, the object of which is to prohibit any trade or calling for the sake of those directly employed in it, as it would be necessary in this case to pursue the effects of the prohibition in its indirect as well as its direct bearings.

Leaving these naughty guns and swords to perform their respective offices, in the hands of those who are commissioned to "burn, sink, and destroy," allow me to direct your attention to those little spears which are never supposed to thirst for life, but whose worst acts are, to occasionally puncture a lady's finger, and to stain a cambric handkerchief. If we examine into the circumstances attending the production of that very harmless article, we shall find that between the period when the steel of which it is made was formed into wire, and that in which, as a finished needle, it is ready to be nimbly plied by the fair hand of industry and beauty, it has committed the most appalling ravages.

We have here taken a manufacture of very great extent, and giving employment to many thousand workmen. Of the persons engaged in the pointing of needles, very few indeed reach the age of forty

years, by far the greater number dying under that of thirty-two. The fine particles of steel which are ground off, are so light as to float in the air, and are so copiously deposited upon the mouth and nostrils as completely to blacken them; much irritation is produced by them in the lining membrane of the nose, and at first a copious mucous discharge is produced from it; but afterwards, the irritability of the parts is exhausted, and they become perfectly dry. The trachea, or windpipe, is next affected; respiration becomes difficult, and an habitual, exhausting cough is produced. Soon, nearly all the animal functions are disturbed, the digestive organs refuse to perform their offices, and the lungs, in particular, become the main seat of that total derangement of the whole system which must soon terminate in death. To find a man who has followed this trade for twenty years, is almost impossible.

I have introduced the pointing of needles as an example of the deleterious effects of the fine dust of steel, but the like evils are experienced in the making of a great number of other instruments of iron as well as of steel. Forks, for example, are finished by what is called dry grinding; that is, by grinding them upon a stone without water. Numerous utensils, also, of cast iron, when finished on the dry stone, or by fine files, give out a dust producing all the effects which I have described, and in an equal degree. To put a youth to these businesses, therefore, is to bespeak for him an early grave; yet society wants, and must have the articles, and there is no more difficuliy in inducing men to follow these trades than there is in enlisting them for the purpose of being killed, *secundem artem*, in the army or the navy; especially if they are to receive a few pence per diem more for this, than for some other species of labour.

Humanity has asked the question, Is there no means of preventing or lessening this evil? and ingenuity has devised a method of accomplishing the object, which it was believed would be effectual. A Mr. Abraham invented what was called a magnetic mouth-piece, to be used by the needle pointers, and dry grinders. This consisted of a considerable number of small magnets connected together by a common frame. The magnets were placed within a small distance of each other, and formed a kind of lattice-work; when these were strapped upon the face, the air which entered the mouth and nostrils must pass between them, and the ferruginous particles would consequently be attracted by, and adhere to the magnets. As might have been foretold, however, without the gift of prophecy, those for whose use they were intended would not wear them. Several causes combined to prevent their doing so, either of which would have been sufficient to govern the conduct of persons such as we are speaking of; these magnets were costly, and as they must frequently be taken off to be cleaned, they were very troublesome: but, worse than this, they were very ugly, and, worst of all, they excited the laugh, and the jeers of the shopmates of those who wore them. If the philosopher can scarcely scorn the world's dread laugh, he must know but little indeed of human nature who would expect better from the class of men who grind forks and point needles. I might go on and write a volume without danger of exhausting this subject; but I am not aware that there could be found more apt illustrations than those derived from some of the most necessary trades, most extensively pursued, and most destructive to the health and lives of those by whom they are pursued. In a despotic government, where human life is held cheap, a tyrant may compel an individual perhaps to wear an iron mask, without offering a reason why; but in a free government, where the life of every citizen ought to be accounted of inestimable value, the only mode of inducing a man to wear one for his own benefit, as well as to do many other desirable and proper things, is to give to him that degree of education which shall elevate him in his own opinion, and induce him to act from motives more worthy of his intellectual nature than those which usually govern persons in walks of life accounted much more exalted than that of the great body of workmen in our manufactories: this is the only remedy upon which I can found any hope; but, were I standing upon the threshold of life, just about to enter upon its duties, and possessing in the commencement of my career the benefit of the few observations which I have made, the little truth I have gleaned in the years which I have numbered, I should even then consider the hope as Utopian that I should live to witness the dawn of such a state of things in the humbler walks of life; for, warmly as I now feel in favour of a system of uuiversal education, and great as I believe the benefits which are to be derived from it, I do not entertain a hope that by any effort, merely human, the great body of any community can be so far elevated above the level at which they now stand, as to induce them to act the philosopher in cases of this description. At all events I am fully of opinion

so far as governments are concerned with the regulation of trades and callings, they ought to be, as they generally have been, confined in their action to the prevention of nuisances; that artisans and manufacturers should be allowed to pursue their own business in their own way; and that "Laninez nous faire," should be their motto.

## PHILOSOPHICAL JOURNALS.

*Edinburgh New Philosophical Journal, No. XLIV.*

THE Scientific Journals are published so very expensively that it is not often the practical man can avail himself of the information they contain, although it is frequently well calculated to assist him in his profession. We shall endeavour to remedy this as far as we can, by giving an analysis of the works as they are published. By this means we hope not only to assist our readers, but also to promote the circulation of the journals which are generally well-conducted and deserving of patronage.

The present number of the Edinburgh New Philosophical Journal contains many papers that will well repay an attentive perusal. The first article, by Mr. Sang, giving an account of an improvement in the construction of Wollaston's Goniometer, and for which the Scotch Society of Arts have awarded him the honorary silver medal, appears likely to be of service in advancing the science of Crystallography. A paper on the "Mineral Springs of Ireland," is concluded; it gives a very interesting account of the phenomena many of them present, and will afford the naturalist many subjects for pleasing speculation. Dr. Bone also continues an article from the last number on the Geography and Geology of Northern and Central Turkey. The present article is devoted to Geology, and the profsssors of the science will find it exceedingly interesting. It determines, we think, satisfactorily, several doubtful questions respecting the geological structure of the country. One of the most interesting papers, however, is that contributed by Mr. Van Hoff, "On the Origin of Meteoric Stones, and more especially on the views entertained on the subject by Berzelius." We have in a former number given the opinion of that celebrated chemist on the subject. There have been three theories advanced in order to account for the appearance of meteoric stones. The *first* supposes that they are either the fragments of shattered planets, or themselves small planetary bodies, which, floating and revolving in space, descend to the earth's surface when they come within reach of the attraction of our globe; or that they are accumulations of loose matter, the original material from which planets were formed. The *second* theory supposes that they are masses ejected from the moon; this is supported by Berzelius. The *third* is that they are of atmospheric origin; that is, that they have been *formed* in the earth's atmosphere from gaseous substances belonging to itself. Van Hoff is inclined to suppose the latter theory, although not entirely, and he adduces many curious observations in support of his views. It appears that in every fall of a meteoric stone, and at the time when the falling body is still at a very considerable height above the surface of the earth—a height amounting probably to many miles—a very loud momentary explosion is heard, like the report of thunder, or a crackling noise, and which is very distinctly audible at great distances. Now this momentary explosion is least easily explained by the idea of the lunar origin of meteoric stones. If such a mass as a detached fragment of rock from the moon fell towards the earth, what could produce on it a momentary violent effect in a region where the earth's atmosphere—if indeed it extends so far—must be so attenuated, that it may almost be compared to empty space? Why there ensues an apparently tremendous explosion in that region, and not in the denser portion of the atmosphere, where the reaction of the latter on the penetrating solid bodies must be most powerful? Another circumstance deserving notice is, that while the meteoric stones themselves are generally small masses, the size of the fire-balls, which accompany their descent, is much larger than they could appear if the fallen masses had only the same dimensions at a considerable height above the earth that they have when upon it. The difference between the size of the fire-balls and that of the solid masses which have fallen from them, amounts sometimes to perhaps a hundred thousand times. From these and other circumstances attending the fall of these phenomena; from the evolution of light; and from the peculiar constitution of the meteoric stones, the writer of the article is led rather to favour the hypothesis that at the time when the explosion and evolution of light occur in a falling meteor, a great chemico-physical operation takes place, which is not merely the accompaniment of the fall of a solid body, or the effect of that fall, *but which forms a new body from the original elements*, and that this new body is actually the falling me-

teoric stone. Yet Van Hoff does not think this theory quite sufficient to account for the phenomenon, but he conceives the stones are newly formed from incoherent and probably gaseous materials, by a "great physico-chemical process." How this opinion can be reconciled with the theory of their lunar formation, which he appears to support in other parts of his paper, we are at a loss to understand. The article, however, is well deserving attention. The meteorologist will find several other papers on his science. A description is given of a new anemometer, by which the most minute changes in the force or velocity of the wind, or current of air, may be measured. It resembles a small gasometer like those used in gas-houses. A bent tube rises into an upright cylinder, enclosed in another containing water; the tube rises above the water, in the inside, and the other end, on the outside, is continued some height. Any change in the pressure of the atmosphere will of course affect the air contained within the cylinder, which will accordingly rise or fall in the water according to circumstances. The cylinder being connected with an axis, by means of a rope, its rising or falling is registered; and by this means the force and velocity of the wind may be ascertained. There is likewise "an account of some improved meteorological instruments," by Dr. Trail, which is now for the first time published. The physiologist also will find several interesting papers; one by G. R. Treviranus on the analogy between certain organized bodies found in animals, and the pollen of plants is particularly so. Besides the papers we have enumerated, there are several others well deserving attention, and much scientific information, some of which we shall communicate to our readers at a future time.

## MISCELLANIES.

*Comparison of the Light of the Sun with that of the Fixed Stars.*—In the "Philosophical Transactions" for the year 1767, a suggestion is thrown out by Mr. Mitchell, that a comparison between the light received from the sun and any of the fixed stars might furnish data for estimating their relative distances; but no such direct comparison had been attempted before the time of Dr. Wollaston, whose observations on the subject were communicated to the Royal Society in a paper read on the 11th of December. Dr. Wollaston was led to infer, from some observations which he made in the year 1799, that the direct light of the sun is about one million times more intense than that of the full moon, and therefore very many million times greater than that of all the fixed stars taken collectively. In order to compare the light of the sun with that of a star, he took as an intermediate object of comparison the light of a candle reflected from a small bulb, about a quarter of an inch in diameter, filled with quicksilver, and seen by one eye through a lens of two inches focus, at the same time that the star or the sun's image, placed at a proper distance, was viewed by the other eye through a telescope. The mean of various trials seemed to show that the light of Sirius is equal to that of the sun seen in a glass bulb, one-tenth of an inch in diameter, at the distance of 210 feet; or that they are in the proportion of one to ten thousand millions: but as nearly one-half of the light is lost by reflection, the real proportion between the light from Sirius and the Sun is not greater than that of one to twenty thousand millions. If the annual parallax of Sirius be half a second, corresponding to a distance of 525,481 times that of the sun from the earth, its diameter would be 3·7 times that of the sun, and its light 13·8 times as great. The distance at which the sun would then require to be viewed, so that its brightness might be only equal to that of Sirius, would be 141·421 its present distance; and, if still in the ecliptic, its annual parallax in longitude would be nearly three seconds; but if situated at the same angular distance from the ecliptic as Sirius is, it would have an annual parallax in latitude of 1·8 seconds.

*Temperature of Greenland.*—During the eleven years M. Müller has resided in Greenland, he has only twice heard the sound of thunder, which, repeated by the echoes of the mountains, produced, according to him, a most extraordinary and unusual noise. At Frederikshaab the temperature of the only spring which existed in the neighbourhood, and which is about half a mile east from the establishment, is 37° Fahr., whilst that of the atmosphere is 41°. This spring, which is on all sides surrounded with snow, forms a nearly circular basin, from nine to ten feet in circumference, and is about two feet deep. The temperature of the Greenland huts, during summer, varies from 47° to 54° Fahr., according to the number of inmates, and as the lamp is lit or otherwise. The temperature in the open

was 43°. The height of one of the highest ice-mountains or islands seen by the Recherche, was found by calculation to be 167 feet: it probably had a double base.

*Red-coloured Sea.*—On the 12th of March (to the north of Cape Pilaris, in South America), precisely at noon, we were not a little alarmed by a considerable noise upon deck, and by the order immediately to lie-to. The dirty red colour of the sea had produced the very reasonable suspicion that we were upon a shoal. However, upon sounding, there was no bottom with 130 fathoms. From the topmast, the sea appeared, as far as the eye could reach, of a dark red colour, and this in a streak, the breadth of which was estimated at six English miles, and which here and there spread into short side branches. As we sailed slowly along, we found that the colour changed into a brilliant purple, so that even the foam, which is always seen at the stern of a ship under sail, was of a rose colour. The sight was very striking, because this purple stream was marked by a very distinct line from the blue waters of the sea; a circumstance which we the more easily observed, because our course lay directly through the midst of this streak, which extended from south-east to north-west. The water, taken up into a bucket, appeared indeed quite transparent.

## INSTITUTIONS.

### LECTURES DURING THE WEEK.

*London Mechanics' Institution*, Southampton-buildings, Chancery-lane.—Wednesday, May 17, Dr. Birkbeck, on Osteology.——Friday, 19, Mr. Phillips, on National Melodies, at half-past eight.

*Aldersgate-street Institution*—Wednesday, May 17, Robt. Addams, esq., on Dynamics, at eight.

*Western Literary and Scientific Institution*, 47, Leicester-square.—Thursday, May 18, Mr. Wyld, on the Construction and use of Railways.—*Conversazione* under the direction of Philosophical Class, at half-past eight.

*Eastern Athenæum.*—Wednesday, May 17, N. F. Laba, esq., on the Literature of Poland, at eight.

*Lambeth Literary and Scientific Institution*, Waterloo Bridge road.—Tuesday, May 16, W. Lukeing, esq., on Heat, Dew, Rain and Hail, at half-past eight.

*Poplar Institution*, East India Road—Tuesday, May 16, John Hemming, esq., on Chemistry—Chlorine, at eight.

*Eastern Literary and Scientific Institution*, 88, Hackney-road,—Tuesday, May 16, T. King, esq., M. D. on the Digestive Organs, at eight.

*Mutual Instruction Society*, Great Tower-street.—Monday, May 15, Mr. Mackintosh, on the Electrical Theory, at eight.

*Kentish Town Mutual Instruction Society.*—Monday, May 15, Mr. Holdernesse, on the system of Sunday School Teaching, at half-past eight.

*Bermondsey Mutual Instruction Society.*—Monday, May 15, Mr. Logan, on Phrenology, at a quarter-past eight.

*Finsbury Mutual Instruction Society.*—Tuesday, 16, Mr. Dalton, on Animal Physiology, at half-past eight.

## QUERIES.

*To the Editor of the Penny Mechanic.*

*Printers' Ink.*—Sir, would you have the goodness to inform me through the medium of your useful periodical, how I can make Ink for Copper-Plate Printing, and you will oblige

Yours very Obediently,
A Young Printer.

*Manufacture of Colours.*—Sir, I am induced to write to you to request to know if any of your Correspondents can inform me the best means to procure a Carmine and Lake, or Scarlet and Crimson. Having been a regular subscriber to your valuable work from its commencement, I remain,

Your obedient Servant,
John Young.

*Gold and Silver Inks.*—Can any of your Correspondents favour me with a receipt for making Gold and Silver Inks?

An Ornamental Penman.

*Royal Academy Prizes.*—Sir, Being informed that there are fifteen Medals given every three years at the Royal Academy, I should be glad to be informed of the particular departments of the arts, for proficiency in which, these medals are bestowed.

I am, Sir,
Your most obedient Servant,
G. D. B.

## To our Readers.

*Grateful for the patronage which has been already afforded the work, and anxious to promote a still larger Circulation, the Proprietor of the* Penny Mechanic *respectfully announces his intention of occasionally giving*

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## TO CORRESPONDENTS.

*If* M. K. *can inform us for what particular kind of machinery, or process, the patent was granted, perhaps we can assist him.*

D. *Six shillings per Quarter, and two shillings and sixpence entrance fee.*

X. X. *The combustion of the mixed gasses Oxygen and Hydrogen, upon lime produces the most intense light that can be procured. The light produced by Galvinism upon Mercury is not more powerful*

A Young Mechanic's *communication shall be attended to.*

*All Letters for the Editor should be post paid.*

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# THE PENNY MECHANIC.

A MAGAZINE OF THE ARTS AND SCIENCES.

No. XXX.] SATURDAY, MAY 20, 1837. Vol. I.

POCOCK'S PATENT KITES.



Holloway Press D. A. Doudney.

## POCOCK'S PATENT KITES.

We this week present our readers with an engraving of this singularly-interesting invention, as applied in cases of shipwreck; by which in the last extremity, when all hope of saving the ship is at an end, the distressed mariners may be safely landed, one by one, upon the cliff or the shore. At first sight the case may appear altogether improbable, that there should be sufficient power in the kite to sustain the weight of a man upon the cords to which it is attached; but the inventor himself has dispatched one of the members of his family to a considerable height, and then replaced him upon the ground with the most perfect ease and security. When therefore a strong wind, such as would drive a ship ashore, is taken into the account, the question must be placed beyond a doubt.

We have adverted to the merits of the invention in an early number, and are again induced to do so, in consequence of a rapid journey which the son of the inventor performed from Bristol to London, a few days ago; since which we have had an opportunity of witnessing for ourselves the successful application of the kites to the purposes required. Three gentlemen took their places in the char-volante, on the morning to which we allude, and, though the wind was very moderate, they were drawn with tolerable swiftness. The command which the conductor has over the kites is perfectly astonishing, inasmuch as by the simple pulling of a line, the kite can be thrown right or left, higher or lower, in any direction the wind may require, thus enabling the traveller to avoid any obstacle in the shape of trees, church steeples, &c., which in the course of travelling, might otherwise impede his progress.

We have before us a work of Mr. Pocock's, containing many interesting particulars connected with the kite, from which we propose to make a few extracts for the gratification of our readers. Alluding to his first exploits, the author says, "On one occasion the kite's-string was attached to the end of a board, about six feet long and fifteen inches wide: on this quickly-made sledge one of my sons seated himself. On letting go the string, the sledge was instantly hurried away so unexpectedly, and with a velocity so great, that all attempts to overtake it were quite fruitless. Mezeppa's wild horse was as easy of control. The young solitary *Laplander* courageously kept his seat, the kites dragging him and his novel vehicle over hillocks, and ruts, and beds of furze, till he arrived at the opposite extremity of the Downs, where descending into a quarry on his well-poised sledge, he alighted at the bottom (as it happened) in perfect safety, and when his panting pursuers, who had 'toiled after him in vain,' arrived at the goal, they found the fortunate adventurer still seated on his car, exulting that he had kept possession of his runaway equipage, and that he had so distanced his comrades in the race. By this first perilous journey it was learnt, that no horse or rein-deer in car or sledge could successfully compete with kites in speed, and also that no mode of travelling would be so dangerous and precarious, unless the kites could be controlled and the vehicle directed and stopped."

After mentioning an alteration he has made in the construction of the kites, so as to have more perfect control over them, he says, "The first trial of these sails was on Charleton Pond, an extensive sheet of water belonging to the Earl of Suffolk, the use of that nobleman's pleasure-boat being kindly granted for the purpose; when it was proved beyond doubt, that the kites might be applied with certain success, but it was discovered also that their aquatic application called for many improvements. As, in making the first trial by land, an unexpected occurrence took place, so also did something of a similar nature happen on this occasion. While scudding along, under our buoyant sails, an oar had dropped overboard, and having no means of stopping the boat, we traversed to the nearest shore; there the kites were given in charge to three country boys, while we rowed back to pick up the oar. When returning, we heard a great cry out from the lads on shore: they had been dragged by the kites close to the water, into which, but for the interposition of some young trees, they must inevitably have been drawn, unless self-preservation induced the relinquishment of their charge. The cause of the disaster was this: a fourth boy coming up, and naturally, perhaps, wishing to have a hand in the work, pulled upon the brace-up line, the very one we had given the others peremptory orders not to touch. By this act, the draught-kite was brought into full action, and the more the boys pulled, the more did the kites. However, the juveniles were speedily relieved and informed of the cause of the error; for the moment the lad relinquished his hold of the brace-line, the overwhelming power ceased."

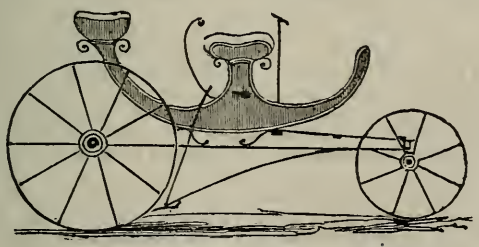
"The power of a kite twelve feet high," says the Editor, "with a wind blowing at the rate of twenty miles in an hour, is as much as a man of moderate streagth

can stand against. With a rather boisterous wind, such a kite has been known to break a line capable of suspending a weight of 200lbs. This kite spreads a surface of forty-nine square feet. It should be particularly noticed, that these may serve as standing ratios, from which, by the rule of proportion, the power of larges kites can be calculated. But let none mistake, by supposing that a kite of thirty-six feet in length has only three times the power in length, and three times the power in breadth, which will make the multiple nine; so that it would lift or draw nine times as much as a kite of twelve feet. Two kites, one fifteen feet in length and the other twelve, have sufficient power to draw a carriage with four or five persons, when the wind is brisk."

In cases of shipwreck the Patentee's portable kites, are unfurled and ready instantly: by them may be suspended very considerable weights; they may be lowered or raised at pleasure, till hold is taken by the grapnel. Other kites would fly only in the direct course of the wind: these may be veered, and dropped to the right or left of the wind's course, to a very considerable angle: and thus, if the anchor does not hold in one spot, it may be elevated, and let down in another, till a proper catch is obtained. But should it be deemed more expedient at once to send a person on shore, with a rope, to make every thing secure, he may be borne above the bustling billows, and alight like a bird, a messenger of good from [illegible] on the cliff or beach, according to the relative situation of the wreck. Again, might so chance, that even a rope would not render all that aid which circumstances required, for should it so unfortunately occur, that female passengers and children were among the despairing number of the shipwrecked, what mode so desirable as to swing them securely in a hammock or cot, and thus transport them, as in an ark of safety, above the foaming billows; and land them over the spray, dry-shod upon the shore?

In the same way, might every one be landed, even the last, if circumstances require. In cases of shipwreck, at a very considerable distance from the land, a patent kite, of the smallest size, would safely tow several men to shore, on the surface of the waves. Again, in despairing cases of ships foundering at sea, of what varied service might these inventions be! One single kite would draw, and aid to buoy up, a considerable spar, or little raft, keeping it from rolling or turning over; serving, at the same time, for a sail, and signal of distress, so lofty and conspicuous, as to attract very distant observation. Again, were the string of a kite fastened judiciously beneath a person's arms, it might support him for hours, and waft him within reach of help, or to some shore, or into some haven;—

"Where aid may soothe away the pangs of fear,
Or pitying stranger drop compassion's tear."



DESCRIPTION OF THE CHARVOLANT.

This vehicle, constructed expressly to be drawn by kites, has the following peculiarities.

1st. Before the charioteer, is an upright spindle, with a T handle at the top; the lower end of this spindle, which runs through the bed of the car, is square, fitting into the socket of a small solid horizontal wheel, fastened to the pivot of the front axle-tree: by this apparatus, termed the guide, the chariot is directed with the nicest precision.

2ndly. There is a regulator, or drag, suspended by a spring, beneath the hinder part of the car; the shoe of this drag is pressed by a lever power on the ground, by which too great a velocity is prevented, or the vehicle suddenly stopped: this is effected without alighting. There are several minor appendages not common to other carriages; as a reel, and places for the chronometer, mariners' compass, &c. This car having moveable shafts may be used with horses, precisely the same as other carriages.

conclude this article by giving one or two anecdotes of eye-witnesses. It is by no means wonderful that persons should refuse credence to their friends, when they doubt the certitude of their own vision; as in the case of a gentleman, who one day meeting the flying expedition, very politely begged the conductors to pull up for one minute: he then intreated permission to examine the wheels, and when he found there was no concealed machinery, "Well," said he, "I suppose I must now believe that your car is actually drawn by kites, though I have often denied the possibility of such a thing; however, as I value my character, be assured I shall never venture to relate what I have seen, being persuaded that should I do so, I should weaken the confidence of my best friends, and poison their good opinion of me for ever. In this case, it appears, the objection was this: It was not conceived possible for the kites to possess power adequate for the drawing a carriage; but had the above gentleman been present on one occasion, an old woman would have read to him the secret at once. He looked no higher for the discovery than to the grovelling wheels; she possessed far more elevated penetration. Addressing a number of her neighbours who were surrounding her as their oracle, she observed, "I'll tell you all about it!" Then, with a deal of *sang froid*, taking a pinch of snuff, she added, "they have got a man up there behind the kite, and he is pulling them along."

D. D.

## REWARDS FOR INVENTIONS.

Governments profess to grant patents, with a view of benefiting the public, by encouraging individuals to exercise their talents for discovery. This profession is false, and not borne out by the facts; otherwise the enormous fees, of from one hundred to three hundred pounds, would not be demanded for each patent-right. The truth is, that governments do not care about patents at all, except so far as they are a commodity whereby revenue may be raised, either for the government or its creatures. Were this not the fact, the expenses of patents ought only to amount to the bare cost of registering them. As regards the public, it is probably more injured by the monopoly of the patent-right than it would be, were the inventors left to take their chance. It is a mistake to suppose that the higher class of invention is promoted to any great extent by the hope of pecuniary reward. Mechanical invention—generally speaking—like music, poetry, philosophy, painting, or acting, is the result of a peculiar temperament of mind, formed by circumstances which the individual is frequently not aware of; but a number of which circumstances have constituted what is called his character. The mechanical inventor is driven forward in his career by an impulse which he cannot resist. If a man is born wealthy, and beyond the necessity of exertion, it is probable that his dormant genius will never be elicited; but a man whose imagination is once devoted to the path of mechanical discovery, can never afterwards abandon it, whether he become rich or remain poor; new discoveries become the unalterable tendency of his faculties, and he will at all times be ready to sacrifice a present certainty for a future contingency. The accumulation of money ceases to be an object with him, when compared with the higher objects he has in view, and which he doubts not will at all times place him beyond the reach of want. He lives in the clouds, and, like the seekers after the philosopher's stone, in the olden time, he makes many useful discoveries, while prosecuting objects which he can never attain. As the "elixir of life" and the "philosopher's stone" have been one cause of the advance of chemical science, so has the "perpetual motion" caused mechanical invention to improve. But in the mean time, the hunters after all three have generally dwelt upon the verge of want. In the present day, to call a man a schemer, *i. e.* an inventor, is equivalent to calling him a needy man. Even in the case of really valuable inventions, useful to the whole community, how rarely do the inventors permanently benefit by them! The speculator, the dealer, is constantly on the watch, to appropriate them, and realize a large fortune, while the inventor is usually left to starve, till he has struck out some fresh plan, whereby to procure another small supply of means. How then can the patent-right be said to encourage invention? Thus it is with the inventive writers of books. With years of labour, and study, they accomplish new discoveries in the regions of thought. The copyright is secured to them, but what avails it? The booksellers see a chance of profit, and the market is deluged with compilations; using the same matter and ideas, couched in varied language. The author angrily complains, but he might as well talk to the winds. The fact is, that the patent-right of the inventor, and the copy-right of the author, are injudicious modes of remunerating public services, and do not accomplish

the desired object. In a more healthy state of the public mind, better means will be resorted to. At present they are a necessary evil.

In England, a man can take out an exclusive monopoly, or patent-right for any invention, not up to that period used in England; even though in another country it may have been in use ever since the days of Noah. The legislators of the United States see the injustice of this, and refuse to grant patents for any invention not entirely original; on the principle, that to give any individual the monopoly of a useful branch of knowledge, to the exclusion of the public, merely because that individual happened to be the first who gained a knowledge of it in a foreign country, without any exertion of industry or application on his own part, would be an injustice to his fellow-citizens, who might otherwise all have an equal chance of benefiting by it. For an entirely original invention they grant a patent-right; and charge, as fees, a few dollars, to cover the expenses of the office.

The principle put forth for the granting of patents is—public benefit. Supposing the discovery to be really valuable, it will be found, that the use of it remains very limited till the monopoly expires; for this reason—the holder can obtain as much advantage from a small return, with a large per-centage, as he can from a large return, with a small per-centage. The former causes him much less trouble; and therefore, he will prefer it, just as the East India monopolists preferred the importation of a small quantity of tea to sell at a large price, to the importation of a large quantity to sell at a small price. In either case of monopoly, the public must suffer.

But there is a great injustice in patent-rights at the very outset, independently of their mischievous tendency. They are barefaced attempts to monopolize the principles of nature, just as the whole raw material of the world has been monopolized. To invent, is—to find out, not to manufacture. A manufacturer is clearly entitled to the benefit of his labour. An inventor merely discovers the existence of certain principles—he cannot manufacture new ones. All principles exist in nature. Because a man happens to be the first discoverer of a new principle, he cannot debar other people from the uses of it, as if he were the manufacturer of it. There must have been an original inventor or finder-out of the principle fire; but that did not make it his exclusive property. Had it been otherwise, fire might up to this period have been a luxury confined to an aristocratic few.

PENNY MECHANIC.
AND SCIENCES.
VOL. I.

Amongst discovers a mode of h makes it k a secret as l selfish nature. he will most lik if there is a surplu induce him to mak he never dreams o vention, unless he the only individual capable of fal it. Were he to attempt to prevent others from fabricating it, he would be either laughed at, or slain, to settle the dispute. Patent-rights, then, are an invention of civilization, and like other monopolies, were perhaps very useful, to encourage genius in the infancy of states, though even that is questionable; for borough towns, the early seats of the arts, have certainly in latter days been as mischievous in retarding improvements, as they were originally advantageous in protecting the rise of improvements. It may be asked, if it would be proper or just, to leave inventors, who are incapable of protecting themselves, to starve? Certainly not. But would it not be practicable to protect the inventor in a much better way, and in one more beneficial to the public at the same time? It has been shown, that the profiters by inventions are not usually the inventors themselves, but mercantile speculators. Would it not, then, be better to make the pecuniary reward hereafter an inalienable annual pension, paid by the public, the amount of which might be regulated by the importance of the invention; the number of people by whom it was used, and the national saving or advantage accruing therefrom? The pension should also terminate with the life of the inventor. Such a method would clearly be to the advantage of the whole body of inventors, for they would thus be saved from the miseries of want which many of them undergo. Should any inventors object to such a mode of remuneration, and, vain of their own abilities, think that they ought still to be allowed to dictate to the public, by means of a monopoly, it would be well to remind them, that there is no obligation on them to make known, any more than there is on the public to use, their inventions. It is a matter of mutual bargain. The skill of the workman who executes is as needful for the perfection of the invention as is the genius of the discoverer who devises it; and neither of them would be one whit benefited, were it not for the public, who purchase and use it. Let not the inventor, then, arrogate too much

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*any* government. In the latter case, all kinds of abuses would occur, some patentees would be favoured—some neglected; we see no means of preventing this; but as it is now, although some inventors do not certainly receive so great a reward as they should, the majority are not neglected if their invention is really useful. The public judge of a patent by the very best test that can be applied to it—its utility. As the usefulness of some inventions, however, are not appreciated sufficiently at first, we certainly think that in such cases government ought to reward the patentee.—Ed. P. M.]

## FACTORY WOMEN.

The factory system is much condemned by some persons, and very strongly supported by others. Like every thing else it has advantages as well as disadvantages attending it, but some of the latter are of a nature that certainly call at once for their immediate removal. Of these we might particularly notice the employment for children, and the great length of time they are obliged to continue at work; but another evil, and one that probably in a great measure produces the first, is the employment of women in the factories. The pernicious consequences of allowing the wives of artizans to give up their domestic duties, for the duties of the workshop, is not seen merely in the destitute and too often depraved condition of their families, or even in their own loss of character, but it is seen more powerfully in its influence on the character of the husband: it is in consequence of his having no home, or none of the comforts that he ought to find at home, that he is induced to waste his money, time, and health, in the public house, when he ought to devote all to the service of his family. The evil consequences of the system were ably pointed out, some years since, by Mr. Gaskill, in a work on our manufacturing population, and his remarks are equally, if not more applicable now, than they were when the book was first published. He truly remarks that the moral influence of woman upon man's character and domestic happiness, is mainly attributable to her natural and instinctive habits. Her love, her tenderness, her affectionate solicitude for his comfort and enjoyment, her devotedness, her unwearying care, her maternal fondness, her conjugal attractions, exercise a most ennobling impression upon his nature, and do more towards making him a good husband, a good father, and a useful citizen, than all the dogmas of political economy. But the factory woman cannot have this beneficial agency upon man's character. Her instincts, from their earliest birth, have been thwarted and pushed aside from their proper channels; they have had no field in which they could be cultivated, no home where their abberations might have been checked, no legitimate object on which her love could be lavished; on the reverse,—her passions have been prematurely developed, her physical organization stimulated into precocious activity, her social affections utterly blighted, her person rendered uninviting by its want of feminine gracefulness; her occupation has destroyed her home sympathies and maternal affections, and finally, in place of seeking her pleasures, enjoyments, and happiness in ministering to the wants and welfare of her household, she seeks her gratification in other, less pure and less womanly stimuli, fatal alike to her health, comfort, and appearance.

Under these circumstances, woman is reduced to precisely the same grade in the social rank which she holds in half civilized countries. She is no longer the companion of man, in the proper meaning of the term; but is a mere instrument of labour, and a creature for satisfying his grosser appetites. It is true, her condition differs in some respects from that of her sex in countries which are called savage; she is not the slave, though she is no longer the companion of man; neither is she the subordinate being whose interests are esteemed so secondary as to be totally unregarded;—but, as far as concerns the better portion of her attributes, she is upon the same degraded level.

Nothing would tend more to elevate the moral condition of the manufacturing population, than the restoration of woman to her proper social rank; nothing would exercise greater influence upon the form and growth of her offspring, than her devotion to those womanly occupations which would render her a denizen of home. No great step can be made till she is snatched from unremitting toil, and made what Nature meant she should be

BIRKBECK COLLEGE



—the centre of a system of social delights. Domestic avocations are those which are her peculiar lot. The poor man who suffers his wife to work, separated from him and from home, is a bad calculator. It destroys domestic economy, without which no earnings are sufficient to render him comfortable; it produces separate interests, and separate sets of feeling—they lose their mutural dependance upon each other—their offspring is suffered to starve or perish—to become, even as a child, the imitator of their bad example—to have its frame permanently injured—to acquire bodily conditions which it must, in its turn, transmit to its own children—for, by their being thus early implanted, they become part and parcel of its very nature—till, in the end, a point of physical declension will be reached, from which the return to a condition approximating to that of the more perfect and valuable part of the species, must be by slow and painful gradations.

## ARITHMETICAL PUZZLE.

*To the Editor of the* PENNY MECHANIC.

SIR,—Although the following little puzzle is not exactly of a *scientific* nature, (partaking more of the *mathematical*), still I have no doubt that to the Juvenile part of your readers, it may serve as an amusing arithmetical puzzle, which if it does not add to their instruction, it certainly will to their amusement; and thus you have it.

Desire a person to set down any figures he may think proper, and multiply them by 9, and their product by any other figure he chooses; that being done, tell him to strike out one figure from the product (any one he likes) and tell you the remaining ones, which you must add together, and see how many times nine will go in them, and add as many figures to the remainder as will make up nine, and those figures will be the one erased; for instance suppose he set down

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                3246
                   9
  1        ---------
  7           29214
   5              6  (or any other fig.)
    2      ---------
     4      175284  (strike out 8.)
  -----
  9)19
  -----
     2   1 wants 8. The fig. erased, to
           make 9.
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Of course when there is no remainder, 9 is the figure struck out. After having once multipli
be multiplied a
you like.

I remain,
Sir,

P. S. I take this opportun
ing to you my thanks; (w
not only from me, but from a
ders), for the small and clear type with which you have accommodated us, thereby embracing "*multum in parvo*," and likewise to request the favour of your informing me, how many Magazines, are intended to complete one volume, 28 being alraedy out. I thought 26 (completing the half-year) would have formed one.

[WE at first intended publishing a *Volume* every half year, but thinking the volume would be too thin, we propose binding the Numbers together once a year, like most of the other cheap periodicals.—ED. P. M.]

AND SCIENCES.

VOL. I.

## INSTITUTIONS.

LECTURES DURING THE WEEK.

*London Mechanics' Institution*, Southampton-buildings, Chancery-lane.—Wednesday, May 24, Dr. Birkbeck, on Osteology.——Friday, 26, Mr. Phillips, on National Melodies, at half-past eight.

*Aldersgate-street Institution*—Wednesday, May 24, C. Johnson, esq., on Botany, at eight.

*Western Literary and Scientific Institution*, 47, Leieester-square.—Thursday, May 25, Mr. Everitt, a popular review of the recent discoveries of Professor Faraday in Electrio Chemistry, at eight.

*Eastern Athenæum*.—Wednesday, May 24, E. Slatterie, esq., on Elocution, at eight.

*Lambeth Literary and Scientific Institution*, Waterloo Bridge Road.—Tuesday, May 23, W. C. Denby, esq., on the Structure and Physiology of the Ear; and Sound, at half-past eight.

*Poptar Institution*, East India Road —Tuesday, May 23, Col. Thompson, M. P., on Free Trade, including the Corn Laws, at eight.

*Eastern Literary and Scientific Institution*, 88, Hackney-road,—Tuesday, May 23, M. Wylie, esq., on the Poetry of Wordsworth, at eight.

*Mutual Instruction Society*, Great Tower-street.—Monday, May 22, Mr. Corcoran, on Hydrostatics and Hydraulics, at eight.

*Kentish Town Mutual Instruction Society*.—Monday, May 22, M. Collis, on the Atmosphere, at eight.

*Bermondsey Mutual Instruction Society*.—Monday, May 22, Mr. Logan, on Phrenology, at a quarter-past eight.

*Mechanics' Institution*, New Road, near Gower Street.—Tuesday, May 23, Mr. Bolton, on the Principles of Political Economy, at eight.

*Finsbury Mutual Instruction Society*.—Tuesday, 23, Mr. Dalton, on Animal Physiology, at half-past eight.

234 ... conclude this article by ...
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should refuse credence to t... *y Mechanic.*
when they doubt the c... Holloway and its vici-
own vision; as in the ca... appalling thunderstorm.
who one day meeting th... serene, with a tolerably
very politely begged ... about one o'clock, when
... late, and about three a
pull up for one minu... sion following one of the
permissi... the ... lightning ever seen broke sud-
... f the neighbourhood. It was truly as-
tou... overnmen... error seemed depicted for the moment u... ery countenance. Self-possession being restored, the inquiry became general, "Where is the mischief?" Providentially it has not extended far. Some newly-built, but unfinished houses, at the end of the Liverpool Road, are considerably injured, and a gentleman who had taken shelter under them was in imminent danger from the bricks falling from the chimney and parapet above him; however, he managed to protect himself with his umbrella, and suddenly fled from his perilous situation uninjured.

When thunder-clouds float low in the atmosphere, as was the case yesterday, there is evidently much danger to be apprehended, and the attention of scientific men would be well directed to the subject. Dr. Franklin's metallic rods would at all times, no doubt, be successful in drawing off the electric fluid from an impending cloud, and averting the danger; but the expense of erecting them, several being necessary to secure a building of any size, is an objection to their general adoption. Would not a single metallic rod to which an electrical kite may be attached answer the purpose? The kite floating over a building or a range of buildings, would, one might imagine, thus carry the electrical fluid silently to the earth. Probably some of your readers, better acquainted with the subject than myself, would be kind enough to reply to this inquiry, and to state what they know from experience relative to the application and success of metallic rods.

I am, Sir,
Your Friend, and Servant in your
Interesting Publication,
*Holloway*, *15th May*, 1837. N. O'MEL.

*Quill Making.*—Sir, I beg to inform Mr. Clements that the object of my inquiry is, to know the *entire* process Quills must undergo in the manufacture or preparation; and how the different colours are given them.

I am, Sir,
Your obedient Servant, C. D.

*Living Model.*—Can any of your correspondents inform me of any place, besides the Royal Academy, where a person can study the living human figure. And I should also feel obliged by being informed of what *modelling clay* is composed.

R. S.

*Works on Botany.*—Sir, I should take it as a favour if you or one of your numerous readers, will inform me of the best publication to instruct a Cottager in the art of mixing earths, or compositions for growing different flowers in a conservatory.

Your very obedient Servant,
J. D.

[Professor Rennie some time since published a very useful little work that may perhaps assist our correspondent; it is called "the Hand Book of Gardening."]

*Fireworks.*—Sir, It would oblige me greatly if you or any of your correspondents could inform me how to make the various coloured fires, similar to those which are bought at the fire-work makers. I know the principal ingredients, but not in what proportions they are used. An early insertion of the above would oblige one of

Your sincere well-wishers,
A. B. Y. Z.

ANSWER TO QUERY

*Tracing Paper.*—Sir, Having observed a query in Number 26 of your valuable Periodical, "which is the best method of preparing Tracing Paper, &c." I take the liberty of answering it.

Take two ounces of Canada balsum, and dissolve them in about four ounces of spirit of turpentine in a bason; then take a quire of silver (not tissue) paper; spread it out smooth, and with a brush (which the painter calls a ground tool) pass over every part of the upper sheet of paper with the varnish, and with the same brush (made as dry as it can be, scraped against the side of the bason), rub the varnish well into the paper, then turn the sheet over the other side also. Enough of the varnish will have pierced through from the upper side also, and indeed the second and third sheets, which is the reason why I spread out the quire of paper at once, by that means a great part of the varnish will be saved; when the sheet is done on both sides, hang it on a pack-thread line to dry, (which will be in about twelve hours) and proceed with the rest in the same manner. R. S.

*Alarums for Clocks.*—Sir, I shall feel much obliged if some of your correspondents can inform me how I can make a cheap alarum for a common Dutch Clock, or where I can purchase one. I wish to have one that can be detached from the clock, if required; and the more simple its construction the better. If any of your correspondents would like to manufacture a few alarums agreeing with the above particulars, I think I could dispose of some, provided they were not very expensive; at any rate I would purchase one myself in order to encourage the inventive genius who should make it. I hope soon to see an answer to this in your columns; and have no doubt but that if individuals who are in want of any little piece of machinery, were to make a similar application to the present, and offer some inducement for exertion, they would soon have their desires gratified.

Yours obediently,
D. N.

## TO CORRESPONDENTS.

Z. Wigo. *The London Mechanics' Institution Merely apply to the Secretary or Librarian.*

*Will* Mr. Clements *favour us with a longer paper on the subject. If he cannot do so conveniently, the one sent shall be inserted.*

M. *should have sent to us by Monday.*

F. *If the postage was not paid the letter was not taken in.*

L. D. L *We intend shortly to give an account of the different Mechanics' Institutions in the Metropolis.*

*Two or three Queries that have been addressed to us personally, shall be answered the first opportunity.*

*We have more than once stated that we should be happy to insert the communications of Working Men, if the subject written on was likely either to benefit any particular class of workmen, or interest our readers generally. We need not say that we shall still be happy to open our columns for such communications; and if a few practical men would send us the result of their experience, we are sure, without injuring them, it would greatly benefit their less-experienced fellow workmen.*

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# THE PENNY MECHANIC.

A MAGAZINE OF THE ARTS AND SCIENCES.

[XXXI.] SATURDAY, MAY 27, 1837. VOL. I.


GREGORY'S ROTARY PUMP.

FIG. 1.

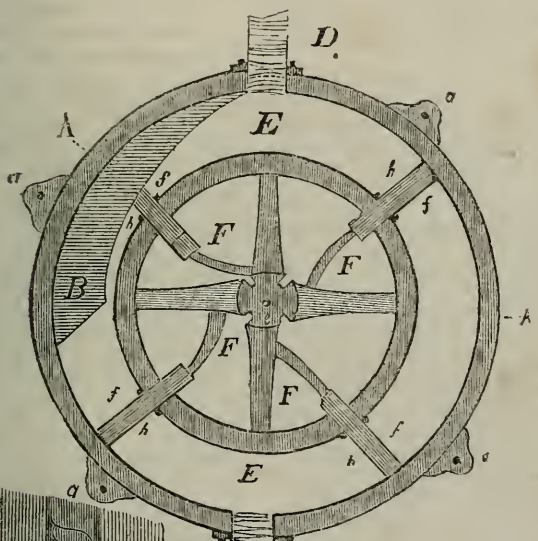
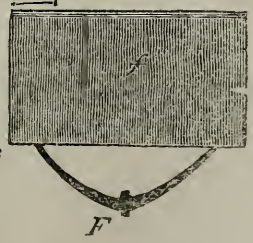
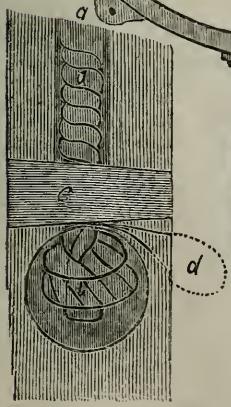



FIG. 2.




MORTON'S WINDOW SASHES.

FIG 3.







Holloway Press D. A. Bradney.

## GREGORY'S ROTARY PUMP.

The following description of a Rotary Pump will perhaps be interesting to the readers of the Penny Mechanic. A A is the cylinder three feet in length, and one foot and a half in diameter, *a a a a* flanches to fix on the cylinder top, B a circular inclined plane by which the float-boards are forced in the revolving wheel E E, fixed on the axis, which works through stuffing-boxes in the cylinder tops, and is turned either by manual or steam power, *f, f, f, f*. The float-boards acting through the stuffing-boxes *h, h, h, h*, and forced out by the springs F, F, F, F, the action of which will be seen better in fig. 2. C is the suction pipe, and D the eduction pipe, *g* fig 2. is the rivet to fix the spring F.

The action in my opinion is free from a great deal of friction which exists in most rotary pumps upon the axis being turned the wheel E E revolves, and the float-boards are forced out, so that a partial vacuum is formed; the water then rushes up the suction pipe, and is forced out of the pipe D into the air vessel, when the float-boards get to the part B they are shut, which prevents the pump choking. If for a fire-engine, I should propose the engine itself being forced off the ground, and the axis of the engine cranked, so as to convert the wheels into fly-wheels by fixing a handle to one of the spokes, and this would be done by a very simple arrangement, too simple to describe. Two cylinders, one for the back wheels, and one for the front, I think two men at each wheel, eight in all, would throw as great a body of water as twelve men in the reciprocrating engine; this is my opinion, and as a practical man I think I may venture to say I am not far out; perhaps some of your readers will favour me with their opinion on the subject.

J. G.

## MORTON'S WINDOW SASHES.

*To the Editor of the* Penny Mechanic.

Sir,—On reading an article in Number 21 of the Penny Mechanic, upon the danger attending the present mode of Cleaning Windows, with a new plan for hanging sashes, by W. Clements; by which the lines may be readily detached, and the evil remedied. ; I herewith send you a simple plan which I have adopted and found to answer exceedingly well.

Yours respectfully,

A. Morton.

DESCRIPTION OF ENGRAVING.

Fig. 3, shows the edge of a stile to an one-and-a-half-inch sash. *a*, the plow-grove with the sash-line *b*, a hole bored with a centre-bit to admit the knot of the sash-line. *c*, a piece of wainscot or other hard wood, dovetailed through the sill and which being smaller at one end may be removed at pleasure by a pressure with the finger. I tie a small piece of cord to the sash-line, making a loop, *d*, which when the line is detached, I pass over the shutter knob, or a small brass hook screwed into the inside lining of the sash frame, thereby preventing the line from running up.

## TEMPERATURE OF THE EARTH.

*To the Editor of the Penny Mechanic.*

Sir,—The peculiar answer which you thought proper to give to my question respecting the "temperature of the Earth below the surface," induces me to believe that you do not perfectly understand my meaning, in consequence of which I beg to explain it more fully.

I am, Sir, a working man, and the nature of my occupation requires that I should be better informed on the above subject, to enable me to accelerate certain improvements in my business; but unfortunately my means are limited to a very few scientific works, which are insufficient for my present purpose, namely, to ascertain at one view, or calculation, by a well-founded rule, the temperature of the interior of the earth at various depths, and to what depth, in the various latitudes an uniform temperature exists. The following is all I have been able to glean on the subject, and which is confined to about latitude 52°., from "the Gallery of Nature and Art," by John Hunter, M.D. F.R.S. "The great difference between the temperature of the open air, and that of deep caverns or mines, has long been taken notice of, both as matter of curiosity and surprise. After thermometers were brought to a tolerable degree of perfection, and meteorological registers were kept with accuracy, it became a problem to determine what was the cause of this difference between the heat of the air, and the heat of the earth; for it was soon found that the temperature of mines and caverns did not depend on any thing peculiar to them, but that a certain depth under ground, whether in a cave, or mine, or a well, was sufficient to produce a very sensible difference in the heat. In observations of this kind, there was, perhaps, nothing more striking than that the heat in such caves was nearly the same in

summer and winter, and this even in changeable climates, that admitted of great variation between the extremes of heat in summer, and cold in winter."

Extracted from the Philosophical and Mathematical Dictionary, by Charles Hutton, L. L. D.—"It is found by observation that the same degree of heat occurs in all subterraneous places at the same depth, varying a little at different depths, but is never less than 36° of Farenheit's thermometer. At 80 or 90 feet, and sometimes much less, the temperature varies very little, and generally approaches to the mean annual heat. The temperature of the cave at the Royal Observatory at Paris, of about 90 feet deep, is about 53½°, varying only about half a degree in very cold years. Mr. Boyle kept a thermometer, for a year in a cave 80 feet deep, and found the liquid remain stationary all the time. Dr. Withering made a similar experiment on a well 84 feet deep at Edgbaston near Birmingham, the temperature of which was found to be 49° in every month of the year 1798."

The opinion of Dr. James Johnson before a Committee of the House of Lords, on tunnelling for the Brighton Railway.

"Question. Do you think that a tunnel 600 yards in length, would produce any injurious consequences? Answer. A tunnel of 600 yards, if it is 80 feet under the surface, must of course have a temperature constantly of about 52 or 53°, consequently in summer, when the temperature of the atmosphere would be summer heat, or 76°, the vicissitudes would be upwards of 20° on emerging from the tunnel. On the contrary, if the temperature was at the freezing point, 32°, the rise of temperature on going into the tunnel would be 20°, and the exit would be on one of equal extent and magnitude.

"Question. In your opinion the temperature of the tunnel would be pretty nearly stationary? Answer. It would be always so, if it was 80 feet below the surface of the earth. You do not think it possible that a tunnel of 600 yards could be so ventilated as to bring it to an approximation to the temperature of the general atmosphere? I think it impossible to alter the temperature, because it must take the temperature of the parts surrounding it; the air might be changed, but whenever changed it would instantly come to the temperature of the solid parts around."

From these observations I have been led to suppose that there is, in a work unknown to me, some fixed criterion to be relied upon; if so, I should feel particularly obliged by your pointing it out, or giving me such information on the subject as you deem serviceable, hoping that I shall not be considered either impertinent or intrusive.

I remain, Sir,
Your most obedient Servant,
W. L. S.

[We are not ourselves acquainted with any work of the kind required by our correspondent, and we do not think that any scale has yet been constructed by which the temperature of the earth, according to its depth, can be ascertained. The geological theory of a great central fire, or other cause of heat near the centre of the earth, is now generally admitted to be true; and from several experiments lately performed by some French philosophers, at Paris, it appears probable that the temperature of the earth does increase in a certain ratio according to the distance from the surface; in what ratio, however, we are quite ignorant; and we do not think it has been definitely ascertained. There are other causes besides the heat of the earth that influence the temperature of the air in caves, tunnels, &c. The air is a very bad conductor of heat, and consequently, unless it is agitated, the influence of the sun on the external atmosphere will not be communicated to that within a cave. With respect to tunnels, we incline to think that Dr. James Johnson, when giving the evidence mentioned above, did not consider that there would be a frequent current of air in them, produced by the rapid passage of the trains; and that consequently the temperature of the air within a tunnel would not differ so materially as he thinks from that of the external atmosphere. In caves there are various causes operating to produce an uniform temperature, besides those just mentioned. The evaporation of moisture is prevented in a confined space, and one of the principal agents in cooling the surface of the earth, does not therefore operate in reducing the temperature of the confined air. The temperature of the *earth* will of course depend on other circumstances. Supposing some kinds of earth to be better conductors than others, of course the heat of particular parts will vary. As we before stated, however, we are not acquainted with any means by which our correspondent can determine this, except by actual experiment. As some of our readers may however be able to answer W. L. S. more definitely than we have done, we have inserted the letter for their consideration.—Ed. P. M.]

## THE HUMAN BODY.

### DIGESTION, ARTICLE II.

The change that is effected in the food while in the mouth, depends very much upon the nature of the animal, and the kind of nutriment which it naturally prefers. Carnivorous animals (those which feed on flesh) do not retain the food so long in the mouth or masticate it so completely, as those that feed on vegetables; because in the former case the food is the same substance as that into which it is to be converted after undergoing the process of digestion; it consists of the same elementary principles as those which constitute the animals who feed upon it, and it therefore evidently does not require to undergo so great a change as vegetable food, which differs so materially from the flesh, bone, &c. into which it is to be formed. The teeth of carnivorous animals are accordingly fitted rather for the purpose of catching and destroying their prey, than for minutely dividing it; while the teeth of animals that feed on vegetable food, on the contrary, appear to be intended almost solely to prepare the food for the action of the chemical agents that digest it in the stomach. Man possesses teeth fitted for performing both these offices, and it is evident, therefore, that it was never intended he should confine himself to one kind of food alone. In some climates, and under certain circumstances, undoubtedly vegetable diet may be better calculated to preserve his health and intellect in a state of vigour than animal food; but it is equally certain that under other circumstances, a mixture of both, or a diet of animal food alone, will more effectually accomplish this object. Hence those persons are certainly wrong who imagine because the Hindoos and South Sea Islanders enjoy excellent health upon vegetable diet, that, therefore every person in this country ought to confine themselves to the same. Indeed, it might as well be urged, because the inhabitants of the Polar regions feed on flesh alone, and consider train oil and tallow candles delicious articles of diet, that Englishmen are naturally intended to subsist on such provision, and ought to do so. It has been found by experiment that a due mixture of animal and vegetable food is digested much quicker, and more effectually than a meal of either separately. This fact alone is quite sufficient to set the point at rest without reference to any other arguments, if indeed any is required in order to convince our readers that a plate of potatoes is all the better for having a nice mutton chop upon it.

Besides the mere subdivision of the food, another imporiant office is performed in the mouth: the food is mixed with the saliva. This may seem a very simple circumstance to many persons, but it is indeed very important; and it has been found, that food introduced into the stomach without having been properly mixed with saliva, is not digested near so rapidly as that which has been thoroughly incorporated with it. The saliva is formed by several glands situate about the mouth, and it has been calculated that they pour into it, during a good meal, not less than half a pint of liquid. The large quantity secreted, shows that it is intended to perform an important office in the animal economy; something more than merely lubricating the mouth and facilitating the passage of the food to the stomach; and it is found that persons who are in the habit of eating their food rapidly, do not enjoy such good health as those who masticate it sufficiently. We know in the case of the lower animals, that some will derive far more nutriment from a certain quantity of aliment than others; the cow, for instance, minutely divides its food, and incorporates it with the fluid of the mouth before passing it into the stomach, and by so doing, derives far more nourishment from it than the horse does from his food, a large portion of which is generally undigested. The gastric juice, the fluid that digests the food, will not act upon the husk of corn, or skin of fruit, and consequently, unless they are removed by mastication, so that the digestive fluid can attack the nutritive food contained within them, it is not digested at all. Paley in his work on Natural Theology, adduces as a proof of the goodness of the Deity, that he has not left the action of the vital organs, such as the heart, &c. under our control. Had such been the case, very many of us would forget or neglect to keep these organs in a proper state of activity. The truth of this observation is fully proved by the circumstance that the only function we are called upon to attend to in the process of digestion, namely, mastication, is in most cases quite neglected, compared with the attention it ought to receive.

After the food has been divided by the teeth, it is formed by the tongue into a small ball, and is passed to the back of the mouth, which from its resemblance to a funnel has been termed the pharynx; and from thence it passes down the æsophagus, into the stomach. Persons not much acquainted with the anatomy of the body, are apt to suppose that the entrance to the stomach and to the lungs is

by the same passage. This is a mistake. The trachea, or windpide, through which air passes to the lungs, is situated *in front* of the aesophagus, or gullet, which conveys the food to the stomach, and every morsel of food we eat is obliged to pass over the top of the windpipe before it can proceed to the stomach. A very beautiful contrivance exists for preventing food passing into the wrong channel. A little piece of cartilage, called the epiglottis, which covers over the top of the windpipe every time we swallow effectually prevents any of the food "going the wrong way" as it is termed, and even when this does take place, the air is expelled from the lungs with such force that the portion of food is immediately ejected. We very seldom hear of persons being suffocated while eating, although this would frequently take place were it not for the epiglottis. A description of this belongs more properly to the subject of "Animal Mechanics," than to Digestion, and we shall accordingly describe it more fully at a future time. In our next paper we shall describe the structure of the stomach, and the important change that is produced in it on the food by the agency of the gastric juice.

## PERPETUAL MOTION.

*To the Editor of the Penny Mechanic.*

Sir,—I have long perused your Mazagine with delight and satisfaction as to its value and good qualities, which I cannot say too much for. I now beg a small space in your columns to say a few words upon the long-sought-for Perpetual Motion, which may be compared to the Fox and Grapes, for if a man cannot come at his wishes he despises them; but that is not the way to come at them, but always to hold your point in view. Now my opinion respecting Perpetual Motion is, that it must some time or other come into operation, if it may be called perpetual motion, for perpetual motion means *to last for ever*, which I think cannot be got, for friction must overcome the motion presently. But if we call it Temperary Motion it would hit the mark much nearer. I do not see why a machine to continue in motion while it lasts, cannot be made, for if we look to the steam-engine, it was almost given up as useless, until the celebrated Watt brought it to such great perfection; but it will allow of much greater improvements yet. Some overwise persons pretend to say that perpetual motion cannot be come at. Why do they say so? Because they know a little, and think they cannot know more. But if they were to set their wits to work properly, instead of abusing other persons' thoughts, they would, I have no doubt, some time or other find it out. It is thus that a great number of useful things are lost, because persons are afraid of making their thoughts public for fear of being ridiculed, which causes great shyness. But they should brave it all.

I remain, Yours truly.

Z. Wigo.

# MANUFACTURES.

## MANUFACTURE OF IRON.

No. II.

Among the useful arts there are none certainly of equal importance in this country with the preparation of iron for the various purposes of utility to which it is applied. The following account of the early state of the art, by Mr. Donovan, will therefore, no doubt, prove interesting to our readers.

By what methods precisely our rude forefathers conducted their smelting processes so as to obtain malleable iron, we are not informed; though, as may presently be shown, the difficulties which they would have to overcome might be neither so many nor so formidable as some persons have imagined. But whether the Britons were indebted for their first knowledge of the art of subjecting iron, or merely for their improvement in that art to their invaders the Romans, it appears to be admitted that the latter established founderies for making iron, and erected manufactories of spears, battle-axes, and other implements, in almost every section of the kingdom conveniently adapted for such a trade. Nor need it be dissembled, that probably under those able instructors our ancestors acquired a proficiency in the working of iron, and thus laid a foundation for that celebrity which their posterity in after ages has so justly obtained.

The earliest operations of smelting in this, as in other countries, would, we may suppose, be extremely simple. According to the hypothesis before mentioned, the putting a quantity of ore upon a heap of wood, and setting the pile on fire, in conformity to the manner in which ores are presumed to have been melted during the burning of forests, was, it may be conjectured, the first rude process by which metals were extracted. But as the force of the fire is greatly diminished when the

flame is suffered to expand itself, and as the air acts more violently in exciting to a fierce heat when it rushes upon the fire with the greater velocity,—a phenomenon too obvious to be neglected even by barbarians,—it is likely that the heap of wood, or charcoal, would soon be surrounded with awall of stone, in which sufficient openings would be left for the entrance of the air, and thus a kind of furnace would be constructed. The Peruvians, we are told, had discovered the art of smelting silver, either by the simple application of fire, or where the ore was more stubborn and impregnated with foreign substances, by placing it in small ovens, or furnaces, or high grounds, so artificially constructed, that the draught of air performed the functions of a pair of bellows; a machine with which they were unacquainted. The use of the bellows was certainly known in England at a very early period, though the precise era of their introduction is not ascertained. A rude contrivance, answering the purpose well enough, is constructed by the Hottentots themselves, who have long understood the methods of smelting both iron and copper,—a knowledge of which they might acquire from the Dutch settlers. Their furnaces are described as of a conical form, and built of clay, which becomes almost as hard as stone. A round opening is left at the top for receiving the ore, and underneath a space for the fire: the pile is open before and behind, not only for admitting the fuel, but the operation of the rude bellows, consisting of a skin bag distended and compressed by the hands.

The heaps of cinders found in various parts of this kingdom, especially in Yorkshire, indicate unequivocally the situations of ancient bloomaries. These are met with as well in the valleys as on the hills: the latter, however, have been supposed to belong to the earlier works, and to a period anterior to the knowledge of bellows. This has been partly inferred from the remarkable fact, that the cinders found on elevated spots almost invariably contain a large quantity of metal, the ore, on account of the inefficiency of the mere air draught, not having been thoroughly reduced. On the other hand, the slag found in low situations, where it is presumed the furnaces were worked after the introduction of bellows, is in most cases so completely exhausted, as not to be worth the trouble of re-smelting, even with modern machinery. In the sixteenth century the process, according to all accounts, was not many degrees advanced, with the exception of the bellows, and a better-constructed furnace, beyond the primitive practice.

After the departure of the Romans the arts began to ebb: at peace for so long a series of years, the inhabitants had almost forgotten what war meant; and, accustomed to the manufacturing of ploughshares and pruning-hooks, they might only remember, as things once heard of, the names of arms. Aroused from this state of torpidity by their northern neighbours, they suffered all the effects of a predatory war before they ventured on resistance; unarmed and dispirited, they appear to have sunk almost without a struggle. The frequency of insult at length aroused their native energy; but military prowess, much less military accoutrements, cannot be created in a day: hence those armies which formerly had made even Romans tremble, were no longer terrible to an inferior enemy. Their weapons were useless from want of exercise, and all their efforts only served to extend the ravages of their invaders, by making manifest the feebleness of the resistance opposed to them. Aided, however, by the Saxons, they drove the barbarous hordes of Picts again into the north, but submitted to those as masters whom they had invited as allies. Thus the ill-fated country, from a lamentable want of unanimity, had been successively enslaved by the Romans, the Picts, and the Saxons—it changed its tyrant, but not its servitude.

Mingling by slow degrees, the Saxons and the Britons in time formed but one people. The frequent quarrels of the princes of the heptarchy rendered the manufacture of arms again a work of necessity. The *Deiri*, supporting their prince by a liberal supply of weapons, and of soldiers hardy enough to use them, seated their Edwin on the throne of Northumbria, and supported him against the attacks of the infamous Penda; and he, in return, encouraged the arts of peace. For him the south Deirans are presumed to have tried a new fabric with their iron, for he had a number of iron dishes forged, which were fastened with chains beside the various springs and fountains which lay on the route generally travelled from one town to another, so that passengers might refresh themselves on their journey. According to local accounts, vestiges of these benevolent arrangements have not long since existed in that part of Deira which is comprehended within the wapentake of Stafforth and Tickhill.

The Norman conquest again laid waste the country in many districts, especially in the north, where William met with the

most determined resistance, and from whence it is probable the arms of the natives were principally derived. But, wherever may have been seated the principal forges of that period, it is certain that the army of Harold, was well supplied with swords and spears, and defensive armour; and, moreover, that a considerable degree of expertness had been acquired in the fabrication of articles from the anvil. One of our historians observes, that immediately preceding the Conquest "the art of working in iron and steel had arisen to such a state of improvement, that even the horses of some of the chief knights and barons were covered with steel and iron armour. Artificers, who wrought in iron, were so highly regarded in those warlike times, that every military officer had his smith, who constantly attended his person to keep his arms and armour in order. The chief smith was an officer of considerable dignity in the court of the Anglo-Saxon and Welsh kings, where he enjoyed many privileges, and his weregeld was much higher than that of any other artificer. In the Welsh court the king's smith sat next to the domestic chaplain, and was entitled to a draught of every kind of liquor that was brought into the hall:" a privilege which many artificers of his class in our own day would not be disposed to make light of!

## MISCELLANIES.

*Improved Church Bell.*—A new species of Church Bell or Gong, has just been invented by a Blacksmith in Thuringia, which is much less expensive than the ordinary Church Bell, but is nevertheless quite as powerful. This Bell consists of three bars of steel forming a triangle.—*Athenæum.*

[We wish the Athenæum had told us how it was made more particularly. A triangle can hardly be called a bell.]

*New Cabs.*—Within the last few months, the public Cabriolets have undergone a greater number of alterations than perhaps any species of vehicle ever did before in so short a time. The original cabs, imported from Paris, had many disadvantages. Although pleasant enough for riding in, one could never make certain of not being thrown out and hurt before we got to our journey's end. Accidents of this kind occurred so frequently, that Mr. Hansom's alteration—lowering the body of the cab, and letting the driver sit above the heads of his fare—was very justly considered a great improvement, so far at least as the safety of the public was concerned. The drivers of these cabs however, appear in constant danger of being thrown over their horses' heads, and although it does not seem that many serious accidents of this kind have happened; and that any objection can consequently be taken to the cabs on this ground, yet they are too heavy—they appear too clumsy—ever to come into general use. Another kind of cab is that in which the passengers sit opposite each other, and side way to the horse, the entrance being behind, with one step. This cab will probably soon supersede all the rest; it has however already undergone six or seven alterations; and probably an improvement will soon be made in the construction of the wheels, which appear as much too small as those of Hansom's are too large. The cab, however, is the most light and graceful kind of vehicle that has ever yet appeared in the streets of London. It is quite safe, and travels through the streets very rapidly. A kind of cab chariot was brought out by a "Safety Cab Conveyance Company," about the time the first alteration was made in the cabs, but it does not appear to have succeeded very well, if we may judge by the small number that are seen in the streets. Altogether, not less than a dozen different kind of cabs may now be seen in London, and nearly all have been introduced within the last six months!

*School for Design.*—Our readers will recollect that a parliamentary grant of £1500 was made some time since, for the purpose of establishing a school of design for the instruction of artizans and others, "in such of the fine arts as are peculiarly applicable to the different manufactures of this country." The school we are happy to say will be opened for the reception of students on the 1st of June next. It will be held in the rooms at Somerset House, lately occupied by the Royal Academy, and the hours of attendance, at first, will be from ten till four, but as it is evident that very few artizans can afford to attend in the day time, of course the school *must* be open in the evening, if it is intended to be of any service at all. It is stated that arrangements are in contemplation for opening an evening school. The subscription required from each student is *four shillings* per week. Any person wishing to attend the school, must apply to the director, J. B. Papworth, esq., at Somerset House, either personally or by letter (post paid) any Monday, Wednesday, or Friday, between ten and four o'clock.

*National Monuments, and Works of Art.*—We beg to call the particular attention of our readers to a meeting that will be held on Monday next, the 29th inst., at one o'clock, at the Freemason's Hall, Great Queen Street, Long Acre, to take into consideration the propriety of petitioning his majesty and both houses of parliament, on the advantages of admitting the public, free of expense, to all depositions of national monuments and exhibitions of art in national buildings, especially to Westminster Abbey, St. Pauls, and the annual exhibition of native talent in the New National Gallery. Perhaps nothing has done more to prevent our artizans acquiring those correct principles of taste for which the workmen on the Continent are deservedly celebrated than the system of exclusion, to petition against which the meeting is called. We have no doubt a petition from a numerous meeting would be attended with success. In the list of committee for effecting the desired object we are happy to perceive the names of some of our best artists, and many members of parliament. George Foggo, Esq., the historical painter, is the secretary. We sincerely trust the meeting will be well attended, and that it will soon effect the object for which it is called.

## INSTITUTIONS.

LECTURES DURING THE WEEK.

*London Mechanics' Institution*, Southampton-buildings, Chancery-lane.—Wednesday, May 31, Dr. Birkbeck, on Osteology.——Friday, June 2, Mr. T. Phillips, on Sacred Music, with Illustrations, both at half-past eight.

*Aldersgate-street Institution*—Wednesday, May 31, C. Johnson, esq., on Vegetables used in Medicine, and the Arts, at eight.

*Eastern Athenæum.*—Wednesday, May 31, E. Slatterie, esq., on Elocution, at eight.

*Lambeth Literary and Scientific Institution*, Waterloo Bridge Road.—Tuesday, May 30, A *Conversazione*, at half-past eight.

*Poplar Institution*, East India Road—Tuesday, May 30, Col. Thompson, M. P., on Political Economy—the Currency, at eight.

*Eastern Literary and Scientific Institution*, 88, Hackney-road,—Tuesday, May 30, J. Mitchell, esq., on Roman Antiquities, at eight.

*Mutual Instruction Society*, Great Tower-street.—Monday, May 29, Mr. A. Lee, on the Formation of the Skull, at eight.

*Temperance Mechanics' Institution*, Aylesbury-street, Clerkenwell, Monday, May 29, Mr. Hatch, on the Character and Poetry of Mrs. Hannah More, at a quarter-past eight.

*Kentish Town Mutual Instruction Society.*—Monday, May 29, M. Collis, on the Atmosphere, at half-past eight.

*Bermondsey Mutual Instruction Society.*—Monday, May 29, Quarterly General Meeting, at a quarter-past eight.

*Mechanics' Institution*, New Road, near Gower Street.—Tuesday, May 30, Mr. Guthrie, on Astronomy, at eight.

*Finsbury Mutual Instruction Society.*—Tuesday, 30, Mr. Nichols, on Entomology, at half-past eight.

## QUERIES.

*To the Editor of the Penny Mechanic.*

*Waterproof Cloth.*—SIR, Will you oblige me by inserting in your Periodical the manner of Making Cotton Cloths Waterproof, which when dry shall be neither greasy, nor have any smell arising from them.

Yours obediently. H. B.

*Work on Flax Factory.*—SIR, Would you be kind enough to inform me, through the medium of your valuable Magazine, of some of the Latest Works upon a *Flax Factory*, comprising the cultivation of Flax and Hemp, Hackle and Spinning Machines, Looms, Weaving, Bleaching, &c.

You would oblige very much,
One of your Subscribers.

ANSWERS TO QUERIES.

*Copper-Plate Ink.*—This composition is made by mixing the best *Frankfort Black* with about sixteen times its quantity of drying *hut* or Linseed Oil. "A Young Printer," however, is recommended to seek the shop of Messrs. Wood and Sharwoods, Aldersgate-street, who deal in Ink and all other materials used by Copper-Plate and other Printers.
C. D. F.

*Gold and Silver Inks* are made by rubbing the leaf metal with Honey in a mortar until it becomes a very fine powder. The honey is then washed away from it, and thin gum-water added to the powder, when it is fit to write with. Dutch gold-leaf, may be used instead of gold-leaf, and will be much cheaper. C D. F.

## TO CORRESPONDENTS.

*We shall be glad to hear again from* H. E., *the paper shall be inserted.*

A Constant Reader. *The communication shall be inserted with a note on the subject next Week.*

J. C. *We do not intend to increase the size of our pages, which would prevent the Numbers being bound together. His suggestion shall be attended to.*

G. Horsfall. *Brandy will not dissolve Gold. The answer is not a good one.*

Mr. Rough's *communication shall receive our early attention.*

*If* Mr. Hatch *will forward us a List of the Lectures of the* Temperance Association, *we will Publish them with those of other Institutions.*

Tiles's *Queries very properly redicule many that we are in the habit of receiving. We have more than once had stranger questions proposed to us, than* how to form the Mixture of Blacking Bottles.

Mr. Douglas's *article on his Improved Steam Boilers, shall be inserted, if possible, next week.*

*We are much obliged to* Mr. Thomas.

Brack's Brother.—China.—W. B.—*and* J. R. Watts, *Received, and shall be attended to.*

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# THE PENNY MECHANIC.

A MAGAZINE OF THE ARTS AND SCIENCES.

No. XXXII.] SATURDAY, JUNE 3, 1837. Vol. I.

[ENLARGED NUMBER.]

## CONSTRUCTION OF ARCHES.

Fig. 1.

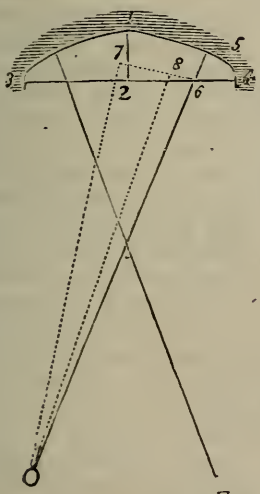



Fig. 2.

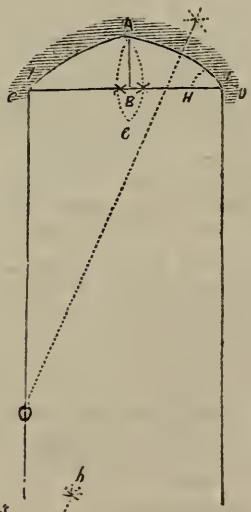
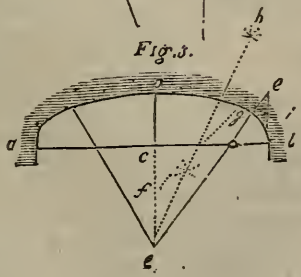



Fig. 3.






Holloway Press: D. A. Doudney.

## CONSTRUCTION OF ARCHES.

*To the Editor of the* PENNY MECHANIC.

SIR,—I have frequently observed many of my fellow-workmen in the building-line greatly at fault in setting out a Gothic, or an Elliptic arch; and in the majority of cases, after bothering their brains a long time, it is at last accomplished by what is technically termed *scowl* of *brow*, and *line* of *thumb*. I send you three figures, for which if you could find room in your valuable Periodical, (which I believe is gaining a large circulation among the class I allude to) you would much oblige

A. M.

### DESCRIPTION OF ENGRAVINGS.

Fig. 1. Let 1, 2, be the height; and 3, 4, the width of the arch. Draw 4, 5, perpendicular to 3, 4, and equal to two-thirds of the height; describe the arch 5, 6, draw 5, 1, and from the point 1, let fall the perpendicular 1, 0, make 1, 7, equal to 4, 5, draw 6, 7, and besect it with the perpendicular 8, 0, cutting 1, 0, in 0, and 6, 0, will be the centres required.

Fig. 2. A, B, the height, and C, D, the width of the arch; with C, D, as centres, extend your compass to A, and describe the arc's A, E; then with the distance X X draw the small arc's C, 1, and D, 1; besect A, 1, with the perpendicular F, 0; draw C, 0, perpendicular to C, D, cutting F, 0, in 0, and 0, H, will be the centres required.

Fig. 3. To describe a semi elipsis or elliptic arch. *a*, *b*, the tranverse or length; *c*, *d*, the conjugate or height; draw *b*, *e*, parallel and equal to *c*, *d*; divide *b*, *e*, into two equal parts at *i*, draw the line *d*, *i*, extend the conjugate and prick down the height at *f*, draw the line *f*, *e*, besect the distance *d*, *g*, on the line *d*, *i*, with the perpendicular *h*, *l*, cutting the line *d*, *f*, in *l*, and *l*, *o*, will be the centres required.

## STEAM BOILERS.

NO. I.

*To the Editor of the* PENNY MECHANIC.

SIR,—Having purchased Number 21 of your Magazine of the Arts and Sciences, upon opening it I was not a little surprised to find therein a controversy between your worthy correspondents, Mr. King and Mr. Puttich, regarding my invention, for Preventing the Explosion of Steam and other Boilers. I purchased your prior numbers, and in Number 7 I found you had given an insertion of part of my specification and drawing; also an editorial article, which I acknowledge and duly appreciate. You will oblige me much if you will give this a place in your columns, that the mistaken notions of Mr. King and Mr. Puttich may be corrected. These gentlemen do not seem to be aware that the water-cisterns and air-tubes shown by the engravings in Number 7, are not intended for the purpose of feeding or supplying the requisite quantity of water consumed by evaporation, but merely showing the way that either water, or air, may be applied; but the one or the other is absolutely necessary, and should be ready to rush in under the water the moment it is forced from the heating surface, that the rarefied vapour which has attained to a greater power of elasticity than the steam, and the gravity of the water, may be partially condensed. By this means the water will be enabled to return instantly to the heating surface, and prevent the formation of the explosive gases; which is the cause of all the explosions of steam boilers, and not steam, as erroneously imagined. My claim is solely for the application of what I know to be perfect preventives of the explosion of steam-boilers. First, in guarding against internal pressure, as shown by the drawing in Number 7; fig. 1, I convert the safety-valve beam into a lever of the first order; it is a self-acting apparatus, by the application of a piston wrought in a perfect cylinder, which is placed upon the boiler roof, and the moving piston becomes a portion of it. A steel-yard is connected to the one side of the piston, as it is pressed up by the steam it pulls the spring which shows every pound pressure the steam attains, and the end of the lever is connected to the other side of the piston rod. When the index has attained to the given pressure, the piston rod acts instantly upon the end of the lever, which lifts the safety-valve, and allows the surplus steam to escape, which takes the power off the piston, and the valve closes. This apparatus may be cased, and locked up. It requires no attention from the engineer, nor is it necessary to be puffing off the steam at every stoppage of the engine, for it cannot attain to a greater degree of elasticity than the given power. At the same time the engine is enabled to start with a full head of steam. The water also is kept upon the heating surface, by the pressure of the steam above it, which keeps the metal from being oxidized, and of course the boiler from exploding.

Secondly, In guarding against *external* pressure as shown by the drawing in Number 7, fig. 1, 2, 3. K, O, S, Q, represent four valves, all of which open inwardly.

When the internal pressure is reduced by either condensation of the rarefied stratum of vapour under the water, or the combustion of the gases, which frequently occupy the same place, a partial vacuum is produced, and the valve is pressed open by the weight of the incumbent atmosphere. The water or the atmosphere (as it may be) will then flow into the boiler under the water, which has been forced up into the steam reservoir. The pressure of the vapour having been less above the water, than that below it, the incumbent atmospheric weight having been forced out of the boiler by the first discharge of steam, only rests upon the external surface of the boiler. The water is left entirely to the fluctuating elasticity of the vapour upon its surface. And if that is suddenly removed by either opening the cylinder safety-valve, or steam cock, the elasticity of the steam above the water is reduced very much below that which is under the water. This permits it to expand itself, by means of which the water is driven up into the steam reservoir in a body. At this moment the atmospheric weight presses open the valve, and the water or air rushes into the boiler, and partially condenses the vapour that is under the water which restores an *equilibrium*, and the water instantly returns to the surface of the heating metal, this prevents it from attaining that degree of temperature which is capable of decomposing the water, and forming it into hydrogen and oxygen gas. When ignited by the electrical spark passing from the body positively electrified, which at this instant is the vapour, to the body negatively electrified, which is the hot metal; but by means of the drops of water which are falling from the watery clouds above, and formed into explosive gas, the metal is partially cooled, which gives it an affinity for electricity. The water is supported up against the roof of the boiler similar to a column of water that is supported in a syphon tube, while the thumb remains upon the orifice of the tube, the weight of the atmosphere being equal to a column of water about thirty-three feet high, it cannot descend while the thumb remains upon the orifice. It is also by a similar principle, that a drop of water is supported at the eaves of houses, and at the points of the leaves of plants, &c. Or by filling a tumbler with water and covering it with paper, and then turning gently the bottom up, the water will be sustained in the tumbler. A boiler is only a tube of a large dimension, and of a different form; but the water and vapour is encompassed by the metal in the very same manner, and cannot be driven to the right nor to the left when permitted to expand under the water, by any sudden reduction of the pressure upon its upper surface. If the internal pressure is a little more than the external, it cannot enter the boiler, and if the safety-valve were to continue open for a short time, and the fire kept up, the rarefied stratum would very soon have possession of the whole boiler, by forcing the water out of it. This fact of the water being not only driven from the bottom, but the whole being forced out of the boiler, is stated in the Franklin Institute, Vol. 8, Number 3, p. 145—6. "It was stated by one of the newspapers that upon the trial of a model-engine, the steam was raised in a small high-pressure boiler, the safety-valve of which was lifted by hand, the steam was immediately followed by water, and ultimately the whole of the water in the boiler was expelled through the valve, and a solution of the phenomena was required." Having quoted the above Mr. Franklin, Peale says, "This is a fact of immense importance in the management of an engine, and yet it is one that was not anticipated by men of science, and of which even practical engineers were uninformed. In company with several engineers, and other gentlemen of science, at a recent trial of a locomotive engine, I was witness to a case exactly in point; it was in action without locomotion, the wheels being raised so as to prevent adhesion, and the gage cocks all indicated water, the engine was then stopped; when, to the surprise of those present, no water was found at the lowest cock, and no human being could ascertain what was the height of water in the boiler at that time, a circumstance that should never occur, for reasons that every one who has any knowledge of the subject must know and admit."

I am apprehensive you will think this communication too long, which obliges me to desist from adding any more at present.

I am, Sir,
Your most obedient Servant,
JOHN DOUGLAS.

## LIGHTNING CONDUCTORS.

*To the Editor of the Penny Mechanic.*

SIR,—In answer to your correspondent "N. O'mel, page 240," I think that buildings might be protected from the effects of lightning, by fastening to the highest parts of such buildings glass rods with metallic points, having a communication by chains to one of Dr. Franklin's metallic rods,

the points at the top of the glass rods would draw the electric fluid from the clouds, and as glass is a non-conductor, it is obvious that it would be conveyed by the chains to Dr. Franklin's rods, by which it would be silently conducted to the ground. Care should be taken that the chains do not touch any part of the building. If you think this worthy of a place in your valuable work, I shall be obliged.

I am, Sir,
Yours truly,
J. R. Watts, M.D.

[We do not think either the suggestion of Mr. N. O'Mel, or of Mr. Watts, any great improvement on Dr. Franklin's conducting rods. An electrical kite might be useful, if it could always "be kept floating over a range of buildings," but it might be hanging down at the very time it ought to be flying about. One good conductor, made of a stout rod of iron, with a number of long branches, over different parts of a building, would perhaps be preferable to either of the plans proposed. Indeed, Mr. Watts merely suggests that these rods, or chains, should be supported on glass pillars, which might be preferable to having them depend for support on the upright rod alone.—Ed. P. M.]

## ARITHMETICAL PUZZLE.

*To the Editor of the Penny Mechanic.*

Sir,—In the Arithmetical Puzzle, page 239, Penny Mechanic, Snubby Gong says "when there is *no* remainder, *nine* is the figure struck out." Allow me to ask your ingenious correspondent, how it follows *of course*, that nine was the figure struck out in the following examples?

| | |
|---|---|
| 1234 | 2143 |
| 9 | 9 |
| 11106 | 19287 |
| 5 | 7 |
| 5553(0) | 135(0)09 |

the sum of each being 18, and divided by 9, leaves no remainder. Now, according to the rule, nine should be the figure struck out; but, in fact, the omission, in each example, was the nought.

W. B.

## JEFFREYS' PATENT RESPIRATOR.

In consequence of the great variation that frequently occurs in the temperature of the atmosphere of this country, we are more subject to disorders of the pulmonary organs than perhaps any other nation on the earth. Indeed the majority of deaths in this country arise from consumption; or disorders which are produced from a diseased state of the lungs. Now there can be no doubt but that many of these disorders could be prevented by a little caution. Delicate young ladies, and invalids, who are predisposed to consumption, are very frequently in the habit of passing out of a warm room at once into the cold atmosphere of the street, perhaps many degrees below that of the room they have been in, without taking any precaution to guard against the injurious effects that must naturally be produced by such conduct. It is only when the dreadful scourge of this country, consumption, begins to exhibit some of its terrible symptoms, or, perhaps, when it has gained such a firm hold of the unhappy patient, that all aid is useless; it is only then that alarm is felt, and means taken to prevent any circumstance contributing to assist the progress of the disease. One of the principal of these predisposing causes, as we have just stated, is the sudden change in the temperature of the air to which many persons so thoughtlessly expose themselves, and Mr. Jeffreys has invented a very ingenious and elegant piece of apparatus by which the evil may be almost entirely remedied. The instrument consists of a little case of metallic bars, placed close to each other, and it can be fitted to the front of the mouth without inconvenience. The patentee in his prospectus, says "The attention of all persons who are distressed by breathing cold air—of asthmatic and consumptive persons in particular—is requested to this small and delicate instrument. It is worn over the mouth, and is so neatly finished as to be in no way disfiguring. It does not at all obstruct the passage of the breath, nor affect the voice. The lowest whisper, audible without the instrument, is heard equally well when it is on. The metallic packet, in which the action lies, is made partly of pure silver, and partly of metal, coated with gold and silver. The materials are, therefore, incorrodible, and will last for many years. *The action of this instrument is to warm the air before it is drawn into the lungs.* The wearer of it can go abroad in the coldest weather, and breathe air warmer than that of summer; or he can have the air he inhales raised to the temperature of mild spring weather. For the former purpose a packet of double action is put into the case; for the latter purpose one of single action is used. The principal upon which the Respirator acts is the following: it allows

the impure air of the breath to pass freely through it, retaining none of it, but it *abstracts from the breath, while passing, all its warmth*, which is effected in a very complete manner. owing to the nature and arrangement of its materials, on philosophical principles. This pure warmth is accumulated in the instrument, and is soon sufficient to warm thoroughly the cold air entering through it, every time the breath is drawn."

It will be seen from this description that the efficacy of the instrument depends upon its being able to absorb the heat of the breath passing *from* the lungs, and give it out to the cold air passing *to them* during inspiration. Mr. Jeffreys has constructed the instrument of the best materials probably that could be employed for this purpose, but as they are very expensive, the instrument is necessarily so, and consequently the use of what we consider to be an instrument of public utility, will be restricted almost entirely to those who can afford the sum necessary to purchase one (from two to three pounds). There are other materials which however for a time may be made to answer the purpose of "the Respirator;" and although we should be exceedingly sorry to deprive Mr. Jeffreys of any of the pecuniary rewards to which his ingenuity is so well entitled, still, as we think the invention calculated to be the means of preserving many lives that must otherwise undoubtedly perish, we think that even he will not object to our pointing out a means by which the principle of his invention may be adopted with cheaper materials, and thus enable those who cannot afford to purchase "a respirator" to form one cheaply for themselves, though not so elegant or durable as those manufactured by him. We think if three or four pieces of thin *gauze wire* were laid upon each other, and folded up lightly in a gauze handkerchief, or a piece of black net or muslin, that if this were then tied over the mouth, as a handkerchief might be, it would to a great extent act as effectually as the respirator in warming the air inspired. The metallic wire of which the gauze is composed would become warm after one or two expirations of the breath, and then it would warm all the air that passed through it into the lungs. Of course it would only be temporary, and would most likely prevent conversation, but as a cheap application of the principle adopted by Mr. Jefferys, we think it is worth a trial. We are glad to see that some of the most eminent physicians and surgeons of the present day warmly recommend "the Respirator," amongst them are the names of Dr. Arnot, Sir B. Brodie, Sir A. Cooper, Dr. Elliotson, Mr. Travers, and many other eminent men.

## STEAM-BOAT VENTILATION.

*To the Editor of the* PENNY MECHANIC.

SIR,—Ventilation, which should be one of the first principles, if not the first, in constructing any thing intended to contain animal life, appears to me to be but imperfectly attended to in this age of general improvement, although certainly much better now than formerly.

My attention was called to this subject by being, a few days ago, on board one of the river steamers. The day was rainy and, consequently, all the passengers resorted to the cabins. I was in the fore-cabin with about seventy others—some were smoaking—and the only vents which I could perceive for the breath of all these persons and the tobacco smoke were the cabin staircase and the chimney. There were windows to be sure, but, as it frequently happens, it was not agreeable to all parties to have any of them open. The river steamers appear to me to be built exclusively for fine weather. Perhaps these few words, or a few from your own able pen, may have some effect on the architects, who, it is to be hoped, will speedily adopt some method for effectually remedying the evil complained of.

I am, Sir,
Yours obliged,
J. F. S.

## CHEAP ELECTRICAL APPARATUS.

*To the Editor of the* PENNY MECHANIC.

MR. EDITOR,—The following is a simple method of exciting and collecting electricity, by means of which a number of curious and instructive experiments may perhaps prove acceptable to some of your readers. Take a quarter of a sheet of coarse brown paper (the coarser the better), and hold it before the fire till it becomes quite hot, then lay it on a piece of dry flannel folded two or three times, or on the horse-hair bottom of a chair, and rub it briskly in one direction with a piece of flannel, or the sleeve of your coat for a few seconds, then on lifting it up by one corner, and bringing the knuckle near it, a crackling sound will be heard; and if performed in a dark room several beautiful flashes of electric light branching out, like trees bare of leaves, will be seen passing from the paper to the knuckle. Thus by simply rubbing a piece of warm paper, we may actually produce the phenomena of thun-

der and lighting, the pale flash of light being identical with the forked lightning, and the crackling sound with the awful and majestic thunderclap.

So much for exciting the electricity. To collect it in sufficient quantities to give the shock, and perform the experiment, procure a common eight-ounce apothecary's phial, and line it inside and out to within a short distance of the neck with tinfoil, which may be had at any optician's or tinman's: two-penny-worth will be found more than sufficient for the purpose. It may be stuck on with gum or paste, and for putting it in the inside, it should be cut into slips, or it will be very difficult to get it to stick; insert in the cork of the phial, a piece of wire, and bend it round so as to touch the tinfoil on the inside; let the other end of the wire project a little way above the top of the cork; and bend it round, as points have a tendency to throw off the electricity. Your apparatus is now complete, and will not altogether cost more than sixpence at the utmost.

Having warmed your leyden phial (as it is called) proceed to rub the paper as before directed, and hold it just over the wire in the cork; the electric fluid will be seen and heard flashing to the wire. Repeat this about twenty times, your bottle will then be charged; take it up in your hand, and apply it to one of the knuckles of your other hand, or to your nose, and you will have a pretty smart shock; indeed, few of my friends are willing to try a second: with this simple apparatus I have succeeded in performing a number of interesting experiments, as the thunder-house, combustion of spirits, &c., and above all in making very powerful magnets of sewing needles and small pieces of steel. It is necessary in all experiments with the leyden phial to make a connexion by touching the tinfoil on the outside, at the same time you touch the wire, the shock passing through the connecting substance.

I am, Sir,
Your obedient Servant,
J. H.

## LIGHT AND VISION.

NO. I.

The nature of light has always been involved in considerable doubt and mystery. The ancients could scarcely be said to have any opinion on the subject, unless, indeed, it could be considered such to affirm that distant bodies could not be put into communication without an intermedium; and that, therefore, there must be something between the eye and the thing seen. What that something is, however, they could only form crude and vague conjectures. One supposed that the eyes themselves emit rays or emanations of some unknown kind, by which distant objects are as it were felt; a singularly unfortunate idea, since it gives no reason why objects should not be equally well seen in the dark—no account, in short, of the part performed by *light* in vision. Others imagined that all visible objects are constantly throwing out from them, in all directions, some sort of resemblances or spectral forms of themselves, which, when received by the eyes, produce an impression of the objects. Vague and clumsy as this hypothesis obviously is, it assigns to the object a power, and to light a diffusive propagation in all directions, which are, the one and the other, independent of our eyes, and therefore goes to separate the phenomena of *light* from those of *vision*. The hypothesis of Newton is a refinement and improvement on this idea. Instead of spectra or resemblances, he supposes luminous objects actually to dart out from them in all directions, particles of inconceivable minuteness (as indeed they must be, having such an enormous velocity, not to dash in pieces every thing they strike upon). These particles he supposes to be acted upon by attractive and repulsive forces, residing in all material bodies, the latter extending to some very small distance beyond their surfaces; and by the action of these forces to be turned aside from their natural straight-lined course, without ever coming in actual contact with the particles themselves of the bodies on which they fall, but either being turned back and *reflected* by the repulsive forces before they reach them, or penetrating between their intervals, as a bird may be supposed to fly

hrough the branches of a forest, and undergoing all their actions, to take at quitting them a direction finally determined by the position of the surface at which they emerge with respect to their course. A very different hypothesis had, however, been suggested about the same period by Huyghens, who supposed light to be produced in the same manner with sound, by the communication of a vibratory motion from the luminous body to a highly elastic fluid, which he imagined as filling all space, and as being less condensed within the limits of space occupied by matter, and that to a greater or less extent, according to the nature of the occupying substance. Thus, in place of any thing actually thrown off, he substituted waves, or vibrations, propagated in all directions from luminous bodies, through this medium, or ether, as he called it. Huyghens, being himself a consummate mathematician, was enabled to trace many of the consequences of this hypothesis, and to show that the ordinary laws of reflection and refraction were represented or accounted for by it, as well as by Newton's. But the hypothesis of Huyghens has not been fully successful in accounting for what may be considered the chief of all optical facts, the production of colours in the ordinary refraction of light by a prism, of which the theory of Newton gives a complete and elegant explanation; and the discovery of which by him marks one of the greatest epochs in the annals of experimental science. This, which has been often urged in objection to it, remains still, if not quite unanswered, at least only imperfectly removed. Other phenomena, however, were not wanting to afford a further trial of the explanatory powers of either hypothesis. The diffraction or inflection of light, discovered by Grimaldi, a Jesuit of Bologna, seemed to indicate that the rays of light were turned aside from their straight course by merely passing near bodies of every description. These phenomena, which are very curious and beautiful, were minutely examined by Newton, and referred by him to the action of repulsive forces extending to a sensible distance from the surfaces of bodies; and his explanation, so far as the facts known to him are concerned, appears as satisfactory as could reasonably be then expected; and much more so than any thing which could at that time be produced on the side of the hypothesis of Huyghens, which, in fact, seemed incapable of giving any account whatever of them. Another class of delicate and splendid optical phenomena, which had begun to attract attention somewhat previous to Newton's time, seemed to leave both hypotheses equally at a loss. These were the colours exhibited by very thin films, either of a liquid (such as a soap-bubble), or of air, as when two glasses are laid together with only air between them. These colours were examined by Newton with a minuteness and care altogether unexampled in experimental philosophy at that time, and with which few researches undertaken since will bear to stand in competition. Their result was a theory of a very singular nature, which he grounded on an hypothesis of what he termed *fits of easy transmission and reflection;* and which supposed each ray of light to pass in its progress periodically through a succession of states such as would alternately dispose it to penetrate or be reflected back from the surface of a body on which it might fall. The simplest way in which the reader may conceive this hypothesis, is to regard every particle of light as a sort of little magnet revolving rapidly about its own centre while it advances in its course, and thus alternately presenting its attractive and repulsive pole, so that when it arrives at the surface of a body with its repulsive pole foremost, it is repelled and reflected; and when the contrary, attracted, so as to enter the surface. Newton, however, very cautiously avoided announcing his theory in this or any similar form, confining himself entirely to general language. In consequence, it has been confidently asserted by all his followers, that the doctrine of fits of easy reflection and transmission, as laid down by him, is substantially nothing more than a statement of facts. Were it so, it is clear that any other theory which should offer a just account of the same phenomena must ultimately involve and coincide with that of Newton. But this, as we shall presently see, is not the case, and this instance ought to serve to make us extremely cautious how we employ, in stating physical laws derived from experiment, language which involves any thing in the slightest degree theoretical, if we would present the laws themselves in a form which no future researches shall modify or subvert. A third class of optical phenomena, which were likewise discovered while Newton was yet engaged in his optical researches, was that exhibited by doubly refracting crystals. In what the phenomenon of double refraction consists, we have already had occasion to explain. The fact itself was first noticed by Erasmus Bartolin in the crystal called Iceland spar; and was studied with attention by Huyghens, who ascertained its laws, and referred it with remarkable in-

genuity and success to his theory of light, by the additional hypothesis of such a constitution of his ethereal medium within the crystal as should enable it to convey an impulse faster in one direction than another: as if, for example's sake, we should suppose a sound conveyed through the air with different degrees of rapidity in a vertical and horizontal direction. Some remarkable facts accompanying the double refraction produced by Iceland spar, which Bartolin, Huyghens, and Newton, had observed, led the latter to conceive the singular idea that a ray of light after its emergence from such a crystal acquires sides, that is to say, distinct relations to surrounding space, which it carries with it through its whole subsequent course, and which give rise to all those curious and complicated phenomena which are now known under the name of the *polarization of light*. These results, however, appeared so extraordinary, and offered so little handle for further inquiry, that their examination dropped, as if by common consent; Newton himself resting content with urging strongly the apparent incompatibility of these properties with the Huyghenian doctrine, but without making any attempt to explain them by his own. From the period of Newton's optical discoveries to the commencement of the present century, no great accession to our knowledge of the nature of light was made, if we except one, which, from its invaluable practical application, must ever hold a prominent place in the annals both of art and science: we mean, the discovery of the principle of the achromatic telescope, which originated in a discussion between the celebrated geometer Euler, Klingenstierna, an eminent Swedish philosopher, and our own countryman, the admirable optician Dolland, on the occasion of certain abstract theoretical investigations of the former, which led him to speculate on its *possibility*, and which ultimately terminated in its complete and happy execution by the latter: a memorable case in science, though not a singular one, where the speculative geometer in his chamber, apart from the world, and existing among abstractions, has originated views of the noblest practical application.*

* There seems no doubt, however, that an achromatic telescope had been constructed by a private amateur, a Mr. Hall, some time before either Euler or Dollond ever thought of it.

## LIST OF PATENTS.

ENGLISH.—MACHINERY.

*Austin, Edward*, of Warwick-place, Bedford-row, for an improved method of raising sunken vessels. From 12th May, for six months.

*Barker, Joseph*, of Regent-street, Lambeth, for improvements in making umbrellas and parasols. From 29th April, for six months.

*Baylis, Thomas*, of Tamworth Stafford, Civil Engineer, for improvements in heating and evaporating fluids. Communicated by a foreigner residing abroad. From 6th May, for six months.

*Bell, William*, for same purpose. From 11th May, for six months.

*Boydell, James, Jun.*, of Dee Cottage, near Hawarden, Flint, for improvements in propelling carriages. From 11th May, for six months.

*Debae, Pierre Barthelemis Guinibers*, of Brixton, Surrey, Civil Engineer, for improvements applicable to railroads. From 13th May, for six months.

*Devaux, Charles Pierre*, of Fenchurch-stteet, for an improved apparatus for preventing explosions of boilers, or generators of steam. Communicated by a foreigner residing abroad. From 23rd May, for six months.

*Freeman, Charles Joseph*, Frederick Place, Surrey, for improvements in rolls for rolling iron, &c. From 25th May, for six months.

*Hayman, George*, Sidwell-street, Exeter, for improvement in two-wheel carriages, from 6th May, for six months.

*Hague, John*, Castle-street, Wellclose-square, Engineer, for improvements of wheel for carriages. From 10th May, for six months.

*Heathcoat, John*, Tiverton, Devon, Lace Manufacturer, for an improved method of manufacturing ornaments and figures upon gauze, muslin, &c., and also certain apparatus to be used in manufacturing such ornamented work. From 4th May, for six months.

*Ingrand, Thomas Wells*, Birmingham, for improvement in the manufacture of certain descriptions of buttons, and in the tools used in manufacturing the same. Communicated by a foreigner residing abroad. From 4th May, for six months.

*Leak, Elijah*, of Hanley, Stafford, for certain improvements in the construction of shutters and sashes for windows, and in the fitting and using the same. From 23rd May, for six months.

*Nairne, William*, of Millhaugh, near Methven, Perth, for certain improvements in the machinery of reels, used in reeling yarns. Communicated by a farmer residing abroad. From 8th May, for six months.

*Rhodes, William and Robert Hamingway*, both of Earls Heaton, near Dewberry, York, for improvements applicable to machinery for carding and piercing wool, in process of manufacture of woollen mills. From 22nd May, for six months.

*Robertson, William Angus*, of Peterborough-court, Fleet-street, for improved machinery for sculpturing and otherwise fixing and working marble, &c., and for taking copies of the work produced thereby, or by the ordinary means; and also an improved method of taking casts of the living human face or other form. Communicated by a foreigner. From 6th May, for six months.

*Steinkeller, Peter*, of the London Lime Works, Wenlock-road, for certain plates or tiles made of lime or other mixtures, applicable to roofs. Communicated by a foreigner residing abroad. From 8th May, for two months.

*Ross, Henry*, of Leicester, for improvements in the combing of wool and goat's hair. From 6th May, for six months.

*Smith, Samuel and William*, of Luddenfoot, near Halifax, York, for improvements in machinery for combing or clearing sheep's wool and goat's hair. From 23rd May, for six months.

*Spurgin, John*, of Guildford-street, Russell-square, for an improved method of propelling vessels through water. From 8th May, for six months.

CHEMISTRY.

*Bell, Thomas*, of South Shields, Durham, for improvements in the manufacture of sulphate of soda. From 8th of May, for six months.

*Crawford, Henry William*, No. 5, John-street, Berkeley-square, for an improvement in coating iron and copper for preventing oxydation. Communicated by a foreigner. From 29th April, for six months. Patent also granted for Scotland.

*Dixon, Alexander and James*, of Cleckheaton, near Leeds, York, for improvements in dyeing. From 29th April, for six months.

*Mollerat, Jean Baptiste*, 27, Leicester-square, for an improvement in the manufacture of gas for illumination. From 2nd of May, for six months.

## PATENTS FOR SCOTLAND.

MACHINERY.

*Amesbury, Joseph*, of Burton Crescent, Middlesex, for certain apparatus for the relief of stiffness, weakness, or distortion of the human spine, chest, or limbs.

*Bunnett, Joseph*, of Newington Causeway, Southwark, for improvement in window shutters.

*Coles, William*, of Charing Cross, for improvements applicable to locomotive carriages.

*Cane, George*, of Ynisceddywyn Iron Works, near Swansea, for an improvement in the manufacture of iron.

*Campbell, John Gordon, and John Gibson*, of Glasgow, for an improved process of manufacturing silk, and in combination with certain other fibrous substances.

*Hardy, James*, of Wednesbury, Stafford, for improvements in the manufacture of iron into cylindrical and other forms suited for axletrees and other purposes.

CHEMISTRY.

*Nichels, Christopher*, of Guildford-street, Lambeth, for implements in preparing and manufacturing Indian rubber, applicable to various purposes.

*Partridge, Nathaniel*, of Elm Cottage, near Stroud, Gloucester, for improvements in mixing and improving oil paints, whereby a saving of ingredients commonly used may be effected.

*Poole, Moses*, of Lincoln's Inn, Middlesex, for improvements in making fermented liquors. Communicated by a foreigner residing abroad.

*Novel Ascent in a Fire Balloon.*—A young gentleman of the name of Sneath, residing at Mansfield, has made a large fire balloon of fire-proof canvass. On Wednesday evening he was anxious to try its buoyancy, and, inflating it, took it at nine o'clock to the Bleak-hill, where he thought he had secured it to the earth. He got into the car to see what weight it would carry, when the sudden bounds given by the machine disengaged the cords, and he rose in the air. He remained in the balloon, floating about, until eleven o'clock, when the machine began to descend, and the grappling caught in a hedge near Spondon. Here, however, another difficulty presented itself: if he got out of the car the balloon would rise, so he determined to keep his seat until the next morning, when, to his great joy, he received the assistance of some countrymen about half-past four, when he packed up his ponderous machine and conveyed it to the nearest town (Derby), where it remains.

# INSTITUTIONS.

LECTURES DURING THE WEEK.

*London Mechanics' Institution*, Southampton-buildings, Chancery-lane.—Wednesday, June 7. Quarterly Meeting.—Friday, June 9, Mr. T. Phillips, on Vocal Music in Dramatic effects with Select Scenes, both at half-past eight.

*Aldersgate-street Institution*—Wednesday, June 7, C. Johnson, esq., on Vegetables as subservient to the more immediate Necessitics of Life, at eight.

*Poplar Institution*, East India Road —Tuesday, June 6, Col. Thompson, M. P., on the "Greatest Happiness Principle" of Bentham, at eight.

*Eastern Literary and Scientific Institution*, 88, Hackney-road,—Tuesday, June 6, A. Catherwood, esq., on Poisons, at half-past eight.

*Mutual Instruction Society*, Great Tower-street.—Monday, June 6, Mr. A. Lee, on the Structure of the Brain, at eight.

*Kentish Town Mutual Instruction Society.*—Monday, June 5, Mr. Showler, on Digestion, at half-past eight.

*Mechanics' Institution*, New Road, near Gower Street.—Tuesday, June 6, Mr. Guthrie, on Astronomy, at eight.

*Finsbury Mutual Instruction Society.*—Tuesday, June 6, Mr. Dalton, on Chemistry, at half-past eight.

## QUERIES.

*To the Editor of the Penny Mechanic.*

SIR,—In your Magazine of the 13th instant, you bring forward some opinions of Professor Faraday's, respecting the manner persons should manage their breathing to enable bystanders to afford assistance to those who have been overcome by inhaling noxious air in cesspools, &c. Will you allow me to ask were a man so circumstanced, and were he to leave the collar fast, and draw a smock frock or a shirt over his head, would he not by that means keep so much good air near his mouth, and exclude the bad air, as would enable him to go in and out of such a place with safety? The experiment seems to me worth the trial. C. W.

ANSWERS TO QUERIES.

*To Remove Ink Stains from Books, Linen, &c.*—Apply to the spot, muriatic acid diluted with five or six times its weight of water, and after a minute or two, wash it off: repeating the application as often as may be found necessary. Strong solutions of oxalic, citric, and tartaric acids, also effect the purpose, and being less likely than the muriatic acid to injure the fabric they are applied to, are preferable. A CHEMIST.

*To Form Carmine.*—Take three pints of water that has been boiled in a pewter vessel, into this put one ounce of finely-powdered cochineal, and keep the water boiling for about ten minutes; add then half a dram each of alum and supertartrate of potass (cream of tartar) and keep the mixture on the fire for a minute or two longer. When the gross powder has subsided the decoction is to be removed to a tall cylindrical vessel, which must be covered over, and left free from disturbance. The carmine will then settle at the bottom of the vessel. The liquor must then be gently poured off and the powder gradually dried. An inferior carmine may then be obtained from the coloured liquor poured off from the first carmine, by the addition of a solution of muriate of tin. C. D. T.

*To Form Lake.*—Boil chips of fine *Brazil* wood in water and strain the decoction, and then add to it a solution of tin in muriatic acid, (muriate of tin) which may be purchased of the drysalters. The mixture affords a fine red precipitate, which is the article required.

By precipitating by alum instead of muriate of tin, another kind of lake is obtained.

Various coloured lakes may be obtained by digesting fine Brazil wood in acids, filtering the solution, and precipitating with alum and Ammonia, or alum and potass. Ammonia, however, gives the finest lakes. C. D. T.

*Waterproof Cloth.*—India rubber is decidedly the best material for waterproofing articles of all kinds, and must be applied in solution. The best solvent adapted for common purposes is *Naphtha*, and the purer the better. One gallon of naphtha will dissolve about ten ounces of the rubber. The manner of solution is as follows. The rubber cut into very small shreds is put into the naphtha and left till it becomes very soft. The vessel containing the solvent is then gently warmed (a steam bath is best) and stirred about until the solution is quite free from any undissolved pieces of rubber, and is of an even consistency, similar to honey. It is then fit to be applied, like any other varnish, with a brush to the articles to be rendered waterproof. It will soon dry, and will not impair the flexibility of the article, or be greasey, or have any unpleasant smell. C. D. T.

*Fireworks.—Coloured Fires.*—Sir, I beg to inform "A. B. Y. Z.," that he may manufacture different coloured fires as follows:

*A Blue Fire.*—Eight ounces of meal powder, four of saltpetre, three of sulphur, and three of zinc filings.

*Green Fire.*—Sixteen ounces of meal powder, three of copper filings.

*Red Fire.*—Forty parts of dry nitrate of Ammonia, thirteen parts of finely-powdered sulphur, five parts of chlorate of potass, four parts of sulphurret of antimony; mix intimately in a mortar; the chlorate of potass should be powdered separately.

*Spur Fire.*—Nine ounces of saltpetre, four of sulphur, and three of lampblack.

The above fires are all very brilliant, and I have given the composition of them as made for the theatres. N. N.

## TO CORRESPONDENTS.

C. D. Thomas. *An article* on the Practical Application of Steam to Cabs, *would no doubt suit our pages. We must, however, read it, before we can make any promise that it shall be inserted.*

*We shall make use of the papers forwarded us by* Mr. Watts.

*The request of* China *shall not be forgotten.*

S. W.'*s paper on an Improved method of Baking, we will endeavour to find room for.*

Jack's Brother's kind *note to* Z. Wigo, *on Perpetual Motion, shall appear next week.*

*We should be glad to receive a clearer description of* an Improved Window Sash—*it shall be inserted.*

C. J. G. *had better get an introduction to Jack Ketch; he will explain the mechanism of* the Drop *to him.*

A Constant Reader, *next week.*

J. P. *Will find a description of the Method of Preparing a Solution of India Rubber, in one of our late Numbers.*

*Received.* H Barwick.—W. Nichols.—A. B.—Johnson.—A Chemist.

*Several Queries and Answers must stand over.*

ERRATA, in last Number—*The signature to the two letters in last column should have been* C. D. T. *And for* Hut oil, *read* Nut oil.

London: Printed at the Holloway Press, by D. A. DOUDNEY; published by BERGER, Holywell-street, Strand; and may be had of all Booksellers.

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| Extra Imperial Saxony Wool Dress Coats | £2 18 |
| Surtouts, faced with silk | 3 8 |
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| Buckskin Trousers | 1 8 |
| Washing Waistcoats 7s. each, or three for | 1 0 |
| Ditto Trousers, 10s 6d. or three pairs | 1 10 |

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| Imperial Saxony Wool Dress Coats | £2 12 |
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| Beautiful patterns, Summer Trousers, 10s. 6d per pair, or 3 pair for | 1 10 0 | Spanish Cloaks, a complete circle of nine and a half yards | 3 3 0 |
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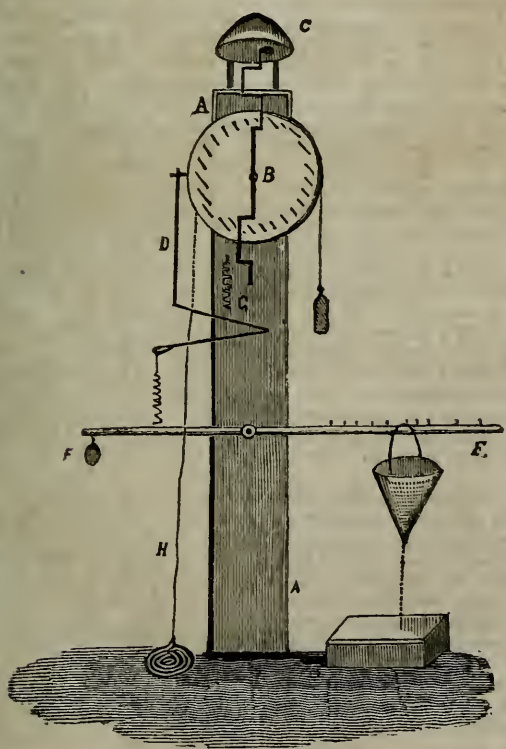
# THE PENNY MECHANIC.

A MAGAZINE OF THE ARTS AND SCIENCES.

No. XXXIII.] SATURDAY, JUNE 10, 1837. Vol. I.

ALARUM.






Holloway Press: D. A. Doudney.

## ALARUMS.

*To the Editor of the Penny Mechanic.*

SIR,—Observing an article headed "Alarums" in the last Number but one of your Periodical, has brought to my recollection, a simple and efficient machine of that description, that I made in my *youthful* days, and which perfectly answered the purpose for which it was intended, viz. (to wake me in the mornings to join my companions on fishing excursions); and having ferretted out the description of it in one of my old copy-books, I herewith send it you, together with a diagram of the same, hoping you will favour me by their insertion, as it is some time since you have had a line from

BRACK'S BROTHER.

### DESCRIPTION OF ENGRAVINGS.

A A is a plank board about six-and-a-half feet long, six inches wide, and half-an-inch thick; which is to be fixed upright against the wall. B is a pinion wheel which may be obtained from any wooden clock-maker, under the name of "alarum pinion;" and from whom may also be had the bell C. D is a small lever connected with the regulating lever F F at one end, and presses against the alarum pinion at the other by a small spring G. The regulating lever is a piece of wood about three feet long, one-and-a-half inches wide, and about five-eighths in thickness. On one end a small weight of about three pounds is suspended, and at the other a tin cone with a minute perforation at its apex, which will contain about five pounds of sand (dried and sifted) placed in a notch agreeing with the hours required, for the sand to run out, before the machine shall strike off. The slightest inspection will now make its operation apparent.

The alarum pinion being wound up by its ratchett pully (which is not shown in diagram), by means of rope H, is prevented from running off by the lever D being pressed against it, by the spiral spring G, and as it can only be relieved by the weight end of the regulating lever preponderating, as the sand gradually discharges itself, it may be made to strike with great exactness, by timeing the distance of the cone from the fulcrum, in hours, half hours, and quarters.

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## PERPETUAL MOTION.

*To the Editor of the* PENNY MECHANIC.

SIR,—From the tenor of your correspondent, "Z. Wigo's" letter, in Number 31, I should to a certainty infer that he has been practising or endeavouring to construct a machine of the description he so confidently fancies will one day be brought to perfection. And I strongly suspect that he has not been successful in his attempts, and, moreover, that some of his friends have been very unkindly, "abusing other people's thoughts," which literally means that they have laughed at him, (and I wonder how the deuce they can help it). This is, I suppose, the principal cause of his attacking us "anti-perpetualists." Z. Wigo seems to "brave it all," for he speaks boldly enough; in the course of his letter he says "now my opinion respecting perpetual motion is, that it must some time or other come into operation, if it may be called perpetual motion, for perpetual motion means to last for ever:" which in the very same sentence he flatly contradicts, for he directly says, "which I think cannot be got, for friction must overcome the motion presently." Now, in the first of these lines he states that it must some time or other succeed. It is quite plain he is positive on that point, but yet he doubts, suspects, and then very candidly tells us that "it cannot be got;" was ever any thing more absurd? except his comparison of Perpetual and Temporary, which is to follow; he says, "But if we call it Temporary Motion it would hit the mark much nearer." From this sentence we may readily take it for granted as a tacit acknowledgment of its impossibility. In comparing perpetual with temporary, we must allow that in the most ordinary acceptation of the words, that their meaning is widely different. And in the succeeding lines he again contradicts the above, for he says, "I do not see why a machine to continue in motion, while it lasts, cannot be made." So that here again he thinks it may succeed, although just before he has said, "it cannot be got." Well, he goes on again, "Some overwise persons pretend to say it cannot be come at;" he to a certainty is one of these overwise persons, for he himself has said, "it cannot be got:" this is odd enough, for I suppose both expressions amount to the same meaning. And as a kind of finisher he says, "If they were to set their wits to work properly, instead of abusing other persons' thoughts, they would, I have no doubt, some time or other find it out." Now, I should be very much obliged to "Z. Wigo," if he would condescend to inform me how to "set my wits properly to work," for I truly confess my utter ignorance of the proper method. But I am afraid that he is but an "entranced and visionary seer," who has unfortu-

nately found a "loop whereon to hang a doubt," for he constantly contradicts himself, like the unlucky "inventor" of the two Spiral Spring Perpetual Motion Machine, in one of your former Numbers, whom our friend "Brack's Brother," so quickly defeated and anatomised. In fact, Z. Wigo's letter seems written expressly for "Brack's Brother" to have "a slap at," and as I expect an able reply from him to Z. Wigo, I have not said much on the matter, having only pointed out the contradictions and futility of Z. Wigo's notions. And beg to say that Z. Wigo will, "some time or other" find it "no go." And since Brack's Brother and I are both "stamped with one iron," and each of us anti-perpetualists, I shall take the liberty of subscribing myself,

Z. Wigo's
"Overwise" Friend,
JACKS' BROTHER.

## WONDERFUL DISCOVERY.

MR. Thomas Davenport, a Vermont blacksmith, has discovered a mode of applying magnetic and electro-magnetic power, which we have good grounds for believing will be of immense importance to the world. He has now machines in this city, which go very far to warrant the most sanguine anticipations of a total revolution in mechanics. We have not seen them, because our other avocations have prevented it, but we have read Professor Silliman's description of them, and we are convinced from that, that a new era is about to commence in these matters. We recommend to every reader a perusal of the Professor's article on this subject, in the "American Journal of Science and the Arts," for April, 1837. In the mean time we copy the best account that we have seen of the practical operation of the machine in this city, from the *New Era*, whose Editor is *au fait* in these things; only adding that Mr. Edwin Williams is agent for the patentees, and will give all required information on the subject. Who Mr. Williams is will hardly be inquired by those who know any thing about the Annual Register. 1. We saw a small cylindrical battery, about nine inches in length, three or four in diameter, produce a magnetic power of about 300 lbs., and which therefore we could not move with our utmost strength. 2. We saw a small wheel, five-and-a-half inches in diameter, performing more than 600 revolutions in a minute, and lift a weight of 24 lbs. one foot per minute, from the power of a battery of still smaller dimensions. 3. We saw a model of a locomotive engine, travelling on a circular railroad with immense velocity, and rapidly ascending an inclined plane of far greater elevation than any hitherto ascended by steam power. And these, and various other experiments which we saw, convinced us of the truth of the opinion expressed by Professors Silliman, Renwick, and others, that the power of machinery may be increased from this source beyond an assignable limit. It is computed by these learned men that a circular galvanic battery, about three feet in diameter, with magnets of a proportionable surface, would produce at least a hundred-horse power, and therefore that two such batteries would be sufficient to propel ships of the largest class across the Atlantic. The only materials required to generate and continue this power for such a voyage would be a few thin sheets of copper and zinc, and a few gallons of mineral water. Whilst the cost of this new motive power is merely nominal, it is perfectly safe and manageable. There is not a possibility of any shock or explosion, and the whole machinery might be conducted by a child. We hastily announce these important features of this incalculably important invention, preparatory to a more scientific and practical elucidation.—*New York Paper* of April 30.

[As no doubt some of our scientific friends may be able to give us some further information respecting the above, we shall feel obliged for any communications they may be pleased to favour us with on the subject.]

# BIOGRAPHICAL SKETCHES.

## JAMES TAYLOR.

CONSIDERABLE discussion has taken place since the extensive employment of steam power as a means of navigation, respecting the individual to whom the honour of first proposing it is due. This has arisen in consequence of its having been suggested more than once by individuals who neglected or were unable to bring their schemes to perfection, and make them practicable. In 1737 a person named Jonathan Hulls published "a description of a new-invented machine, for carrying vessels or ships out of, or into any harbour, port, or river, against wind and tide, or in a calm. For which his Majesty granted letters patent for the sole benefit of the author, for the space of fourteen years." This scheme was, however, never carried into practical operation, and the subject appears to have been quite neglected until Mr. Taylor, the

subject of our present sketch, again drew public attention to the matter, and was ultimately one cause of steam navigation becoming so general and so extensively useful.

James Taylor was born 3rd May, 1758, at Lead Hills, in Lanarkshire, and when about twenty-seven years of age was engaged by a gentleman of the name of Miller, of Dalwinton, as a preceptor to his sons. For some time previous to this event, Mr. Miller had been endeavouring to employ paddle wheels with vessels for the purpose of rescuing them when in danger. Taylor greatly assisted his employer in his projects, but observing that manual labour was hardly sufficient to effect the object required, it occurred to him that steam power might be employed, and by experiment he soon convinced himself of its practicability. Mr. Miller then advanced money sufficient for conducting the experiment on a more extended scale, and the result was quite satisfactory. In the very excellent, "exemplary, and instructive biography," lately published by Messrs. Chambers, of Edinburgh, there is a short but very clear account of the further proceedings of the inventor and patron, and from that work we learn that in November (1787) Mr. Miller removed as usual to the capital, where his sons attended the university under the charge of Mr. Taylor. The latter, having been empowered by his employer to proceed about the construction of an engine, recommended to Mr. Miller's notice an ingenious young engineer named Symington, who had attempted some alterations upon the steam-engine, and was now residing in Edinburgh for his improvement in a knowledge of mechanics. It was agreed that Mr. Symington should form an engine on his own plan, and that the experiment should be made in the ensuing summer upon the lake of Dalswinton. The construction of the engine occupied several months, and was not completed at the conclusion of that session of the university, so that Mr. Taylor was detained in town, to superintend the operations, for some time after his pupils had returned with their father to the country. When all was ready, he proceeded with Mr. Symington to Dalswinton, where, on the 14th of October (1788), the experiment was made in the presence of Mr. Miller and a considerable concourse of spectators. The boat was a double one, and the engine, which had a four-inch cylinder, was placed in a frame upon the deck. The experiment was successful beyond the most sanguine wishes of any of the parties concerned. The vessel moved at the rate of five miles an hour, and neither was any awkwardness found in the connection of the engine with the wheels, nor hazard apprehended in any considerable degree from the introduction of a furnace into so inflammable a fabric. The experiment was repeated several times during the course of the few ensuing days, and always with perfect success, insomuch that the invention became a subject of great local notoriety. Mr. Miller now formed the design of covering his own and Mr. Taylor's joint invention by a patent; but, in the first place, it was judged expedient, that experiments should be made with a vessel and engine more nearly approaching the common size. For this purpose, Mr. Taylor went to the Carron Foundry, with his engineer, Mr. Symington, and there, in the summer of 1789, fitted up a vessel of considerable dimensions, with an engine, of which the cylinder measured eighteen inches in diameter. In the month of November this was placed on the Forth and Clyde Canal, in the presence of the Carron committee of management, and of the parties chiefly interested. The vessel moved along very smoothly for a space beyond Lock Sixteen, when, on giving the engine full play, the flat boards of the paddles, which had been weakly constructed, began to give way; which put an end to the experiment. The paddles having been reconstructed on a stronger principle, another experiment was made on the 26th of December, when the vessel made easy and uninterrupted progress, at the rate of seven miles an hour. Except in speed, the performances on these occasions were as perfect as any which have since been accomplished by steam-vessels; and the project was now conceived by all parties to have gone through a sufficient probation, so far as the objects of inland navigation were concerned.

The expense of these experiments appear to have frightened Mr. Miller, as he would have nothing further to do in the business; and Mr. Taylor having given up the situation of teacher of his children, had not the opportunity of urging the advantages of his project so much as he could otherwise have done. In the year 1790, while the fame of the experiments was still fresh in the public mind, Mr. Taylor had some hope of introducing his invention with advantage on the Continent. Mr. Fergusson, the younger of Criagdarroch, in writing to his father from Paris, in the autumn of that year, had expressed his belief that Mr. Taylor's scheme might be taken up in Germany, and threw out a series of queries for his

own satisfaction as to its efficiency. On the 15th of August, Mr. Taylor, then residing at Leadeills, received a letter from Mr. Fergusson, senior, requesting him to come to Drumlanrig (where Mr. Furgusson then was on a visit to the Duke of Queensberry), in order to see his son's letter. Mr. Taylor answered Mr. Fergusson's queries in a letter dated September 25th; and in a reply, dated Paris, October 12th, Mr. Furgusson desired further explanations, mentioning at the same time that he had hopes of Mr. Taylor's scheme being adopted by the emperor, in order to lessen the expense of navigation up the Danube, which, owing to the current, was very great. For some time Mr. Furgusson exerted himself to attract the notice of the court of Vienna to the scheme; but all hopes of doing so were in time extinguished, in consequence of the hostilities which the emperor commenced against France. The correspondence, however, is valuable, as showing that two country gentlemen, neighbours of Mr. Miller, and who must have known the report of the country respecting the origin of the invention, regarded Mr. Taylor as the father of its principal part —the application of the steam—and addressed him as the individual properly entitled, as well as qualified, to carry the discovery into effect.

The indifference of Mr. Miller, the direction of public attention to the war which soon after commenced, and the unfavourable situation of Mr. Taylor, in an inland part of the country, and unable of himself to do any thing, conspired to throw the project for several years into abeyance. At length, in 1801, Mr. Symington, who had commenced business at Falkirk, resolved to prosecute a design, in which he had already borne an active and serviceable part. Lord Dundas employed him to fit up a small experimental steam-vessel, which was tried on the Forth and Clyde Canal, but, causing much disintegration of the banks, was forbidden by the Company to be ever set in motion again. This vessel was laid up at Lock-Sixteen, where it remained for a number of years. Mr. Symington afterwards entered into terms with the Duke of Bridgewater for introducing steam-navigation on his grace's canal; but the death of his grace unexpectedly put an end to the negociation.

Some time after, Mr. Fulton, from the United States of America, accompanied by Mr. Henry Bell of Glasgow, when on a visit to the Carron-works, waited on Mr. Symington, and inspected the boat which he had fitted up for the Forth and Clyde Canal. The consequence was, that, in 1807, the former gentleman launched a steam-vessel on the Hudson, and, in 1812, Mr. Bell another upon the Clyde, being respectively the first vessels of the kind used for the service of the public in the new and old hemispheres. Thus, after all the primary difficulties of the invention had been overcome—when the bark was ready, as it were, to start from the shore, and waited only for the master to give the word for that purpose—did two individuals, altogether alien to the project, come in and appropriate the honour of launching it into the open sea. Unquestionably, the merit of these individuals in overcoming many practical difficulties, is very considerable; yet it is clear that they were indebted for the idea to the previous inventions and operations of Messrs. Taylor and Miller, and that, if the latter gentleman had, in the one instance, been inclined, and in the other able, to carry their project into effect at the proper time, they would not have been anticipated in this part of the honour, any more than in the suggestion of the paddles and the engine.

It appears that Mr. Taylor by no means sat tamely by, while Fulton and Bell were reaping the credit due to his labours. He repeatedly urged Mr. Miller to renewed exertions, though always without success. When the vast importance of steam-navigation had become fully established, the friends of Mr. Taylor, who was not in prosperous circumstances, urged upon him the propriety of laying his claims before the government, and soliciting a reward suitable to the magnitude and importance of the discovery. At last, in 1824, he was induced to draw up a statement of his concern in the invention of steam-navigation, which he printed, and addressed to Sir Henry Parnell, chairman of a select committee of the House of Commons, upon steam-boats. He hoped that this narrative might be the means of obtaining from the government some remuneration for the services he had performed to his country; but it had no such effect. Bowed down by infirmities, and the fruits of a long life of disappointments, this ingenious man died on the 18th of September, 1825, in the 68th year of his age.

## HEAT OF THE EARTH.

*To the Editor of the* PENNY MECHANIC.

SIR,—It is an established fact that heat in air increases as its density, which is forcibly shown by the syringe which produces heat enough to ignite German tinder when

the air is suddenly compressed, forming a most useful compendium to cigar smokers, particularly whilst skating—for it matters not how cold the air, or how quick his movements. It is also well known that the higher we go the colder the air, because of its being more rarefied, and is less dense as we go up, hence the eternal snow on the summit of lofty mountains, in spite of their being nearer to the sun. I could extend this, but will go at once to the mines—fluids acting on weight always according to a column of their height as is exemplified in the first principle of hodrostatics and hydraulics, it is clear that the atmosphere in a mine must be denser the deeper we go—therefore according to our first position it must be warmer—a few experiments would very easily establish the rule, although I am not prepared to give an estimate myself. Now as to the hypothesis which maintains that the earth's centre being at a red heat is the cause of the mines being warmer the deeper we go, I should at once abandon it for this reason; first, because we have proofs that our highest mountains and aeronautical ascents approach the sun, (the source of heat) much nearer than the bottom of our mines do to the centre of the earth, still we feel a most sensible difference, the very contrary to what we ought to expect. Now after all when we reckon the greatest depth of a mine, and compare it to the earth's semidiameter it is as the thickness of a leaf, or sheet of paper, would be to a voluminous work, say the Encyclopædia Londinensis complete. Really this seems to me too trifling an approach to the earth's centre to cause any sensible difference in heat. This is a point much discussed on the Continent at this moment, and I hope I shall be able to supply your correspondent "W. E. S." with his required answer, if none of your readers should do so before me.

I am, Sir,
Yours obediently,
P. H. D.

[The density of the air does not affect its actual heat, although from its containing a greater quantity of oxygen in a smaller space than it usually occupies, it may afford more heat to animals during respiration. It is the *sudden* compression of the air by the syringe as mentioned by our correspondent, that causes the evolution of heat. All bodies when compressed into a smaller space than they usually occupy give out heat. If we mix sulphuric acid and water together, heat is given out because the mixture becomes more dense than either the acid or the water separately, but after a short time the mixture cools down to the same temperature as the liquids before they were mixed. We do not therefore think the mere density of the air will account for the heat of the earth in mines.—Ed. P. M.]

## CONVERSION OF SALT WATER INTO FRESH.

*To the Editor of the Penny Mechanic.*

Sir,—I met the other day with an extract from Commander Ross's work of his late expedition for the recovery of the whalers, respecting the easy mode he resorted to for the forming of *salt* water into *fresh*. I am sorry I neglected to make a copy of the extract; but it is very likely you have seen this account.

What I remember of the circumstance is simply this. An iron tank is placed on deck. A leaden pipe is then introduced into the tank conveying the steam from the galley boilers; whilst the steam continues to pass into the tank, it is kept cool by applying wet swabs to its exterior. In this way sixty gallons of water (as pure as that from a spring), were procured daily, being more than sufficient for the consumption.

You are aware, Mr. Editor, that even madness is occasioned from the want of water on ship-board; and you will do great service to humanity by your remarks on this useful and simple improvement. If you will add any observations on the evaporation or precipitation of the salt, &c. &c.

You will further oblige,
A Constant Reader.

[Dr. Arnott in his Elements of Physics, Vol. II. part one, page 98, suggests a very ingenious, and we think practical way of obtaining fresh water from salt. Suppose any two air-tight vessels, of large size, communicating by a tube furnished with a stop-cock; then, if one of the vessels were filled with salt water, and were heated by being exposed to the sun, (its surface being blackened to absorb heat, and protected by glass from the cooling effect of the air), and if the other vessel were made a vacuum, by pumping out from its bottom the water with which it had been previously filled, and were then kept as cold as possible by wetted coverings and a current of air: on opening the stop-cock of the tube communicating with the two vessels, vapour would pass over from the warmer vessel to be condensed in the colder, and there would be a distillation from the sea-water by the natural action of the sun alone, of a water per-

fectly fresh and pure. Cases have occurred where a knowledge of this fact would have saved shipwrecked crews from perishing by thirst; and there are rocky islands in the ocean where there is no supply of fresh water, but from precarious rain or importation from abroad, but which might be rendered pleasantly habitable by the adoption of such a means.]

## MISCELLANIES.

*Red-coloured Sea.*—The conclusion of the short note on this subject, in Number 30, was accidentally omitted. Although the water taken up in a bucket as described, appeared quite transparent, yet a faint purple tinge was visible, when a few drops were placed upon a piece of white china, and moved rapidly backwards and forwards in the sunshine. A moderate magnifying glass proved that these little red dots, which with great attention could be perceived with the naked eye, consisted of *Infusoria*, which were of a spherical form, entirely destitute of all external organs of motion. Their very lively motions were only upward and downward, and always in spiral lines. The want of a powerful microscope precluded a more minute examination; and all attempts to preserve some of the animals by drying a drop of water on paper, failed, as they seemed to dissolve away. They were extremely sensible to the effect of nitric acid; for a single drop mixed in a glass of this animated water, put an end, almost instantaneously, to the life of millions that it contained. Poeppig, from whose travels this account is taken, says, that he sailed for four hours, at a mean rate of six English miles an hour, through this streak of coloured sea, which was seven miles broad, before he reached the end of it; and its superfices must therefore have been about 168 English miles square. If we add, that these animals may have been equally distributed in the upper stratum of the water, to the depth of six feet, we must confess that their numbers infinitely surpassed the conception of the human understanding.

*Thames Tunnel.*—At a late meeting of the Institute of Civil Engineers, Mr. Brunel gave an account of the Thames Tunnel. He explained the nature of the former operations of Vazie and Trevethick, by whom a tunnel five feet in height, two feet six inches in breadth at the top, and three feet at the bottom, had been carried more than 1000 feet. But in 1808, the river broke in upon it, and the work was irretrievably lost. It was from the data furnished by this operation, that his opinion of the practicability of the present undertaking was formed. The present excavation is thirty-eight feet in breadth, and twenty-two feet in height, and the support which is requisite for the ground, is furnished by the shield. The shield consists of twelve parallel frames ranged side by side, each frame being divided into three cells or partitions, by two floors. Mr. Brunel explained, by reference to drawings, the adjustment of the floors, the contrivances by which each frame was made to derive support from, or assist in supporting its neighbour, as necessity might require; and the manner in which it was advanced. Each frame stands on two legs, and advances, as it were, by short steps; having, for this purpose, an articulation very like that of the human body. The advantage of the system of building by rings, which he had adopted, had been fully demonstrated by the fact of the brickwork having sustained two eruptions, and yet exhibited no symtoms of rupture. The chasm formed at the last eruption absorbed more than 80,000 cubic feet of clay bags, before the workmen could re-enter the works. The greatest inconvenience under which they laboured, was the want of a drain: they had attempted to make one—but, getting into the stratum of quicksand fifty feet thick, which is at a small depth below them, were obliged to abandon the project. The land springs were a great source of annoyance; many of these were extremely offensive, and produced cutaneous eruptions, and were a great source of annoyance to the workmen. The difficulties of the work are vast, but there could be no doubt, but that in time they would be surmounted: the progress at the present point is necessarily exceedingly slow. The increase of the water informs them of what is going on above, and they guard against it accordingly. They had been much troubled by the unusually high tides of the present spring; the change from low to high water is exceedingly trying; in the natural ground it is usually attended with an increase of water, but in the ground made with clay bags, with a diminution. The works had advanced 127 feet since the introduction of the new shield. Some inquiries were made on the means adopted for ventilating the works, and considerable discussion took place on the methods of ventilation by rarefaction and condensation—that is, by drawing out or forcing in air. Mr. Brunel stated, that respiration and the pulse were slower in the diving bell, where condensed air

was breathed, than under other circumstances.

*Shoes and Gloves.*—M. Say estimates the number of shoes made in France at one hundred million, and the salaries of the workmen at three hundred million of francs every year. The value of leathern gloves manufactured in France, annually amounts to thirty million of francs. The establishments of this kind in Luneville alone, employ ten thousand workmen. England takes from France 1,500,000 pairs every year.

*The Tee-totalers.*—A gentleman of our acquaintance dining with a strenuous advocate of tee-totalism lately, in the course of conversation, observed, "You consider, then, do you, that I am to regard even a glass of ale as my enemy?" "Most certainly," was the reply. "Then," said the gentleman, deliberately taking his glass and bowing to his friend, "I am commanded to love my enemies," and with that drank its contents.

## INSTITUTIONS.

### LECTURES DURING THE WEEK.

*London Mechanics' Institution*, Southampton-buildings, Chancery-lane.—Wednesday, June 14, Colonel Thompson, M. P., on National Economy.—Friday, 16, N, F. Zaba, esq., on the Literature of Poland, both at half-past eight.

*Aldersgate-street Institution*—Wednesday, June 14, T. King, esq., on the Nervous System of Man, at eight.

*Eastern Athenæum.*—Wednesday, June 14, C. Johnson, esq., Second Lecture on the History of Antiquities of Stepney, at eight.

*Poplar Institution*, East India Road—Tuesday, June 13, Dr. Birkbeck, on the Measurement of Time, at eight.

*Society of Arts*, Adelphi.—Tuesday, June 13, H. Wilkinson, esq., on the Manufacture of Sword Blades, at eight.

*Eastern Literary and Scientific Institution*, 88, Hackney-road,—Tuesday, June 13, J. D. Holme, esq., on the Science of Phrenology, at eight.

*Mutual Instruction Society*, Great Tower-street.—Monday, June 12, Mr. Robinson, an Essay on Suicide, at eight.

*Kentish Town Mutual Instruction Society.*—Monday, June 12, Mr. Oakes, on Geography and Chronology as connected with History, at half-past eight.

*Mechanics' Institution*, New Road, near Gower Street.—Tuesday, June 13, Mr. Kisson, on the Production, Accumulation, and Distribution of Wealth, at eight.

*Finsbury Mutual Instruction Society.*—Tuesday, June 13, Mr. Dalton, on Chemistry, at half-past eight.

## QUERIES.

*To the Editor of the Penny Mechanic.*

*Red-Coloured Ivory.*—Sir, In consequence of several ineffectual attempts having been made to Dye Ivory an *Uniform Red Colour*, I should feel much obliged to any of your readers if they could inform me how it can be done; and if any, what mordant it would require? The insertion of this in an early number of your valuable little work will much oblige EBOR RUBRUM.

SIR,—When different earths are mixed together they become either hard, or soft, according to their nature; and having generally found blacking, and other bottles to approach the hardness of some stones, and to be even harder than many, I should be obliged if any of your correspondents can inform me of the nature of the composition of which these bottles are made, as I wish for something of the kind for the purpose of an invention.

I am Your obedient Servant,
TILES.

*Baking Provisions.*—A correspondent has written to us suggesting a plan by which he thinks a very important culinary operation, "baking," can be performed at home, over a common fire, as well as in the oven of a bakehouse. He proposes "a short iron oven, made like a saucepan, with an outside sheet of iron to keep the sides from getting cool." The heat and smoke should pass between the oven and its "case." For those who have not the convenience of a kitchen range with an oven, something of this kind, if manufactured cheaply, would no doubt be found exceedingly useful.

### ANSWERS TO QUERIES.

To "G. D. B."—*Royal Academy.*—None but students of the Royal Academy of Painting, &c., can become candidates for the medal offered in the different schools of that institution.

*Alarums* are to be obtained as low as 12s. each, at N. Vogt's, 26, Cleveland Street, Fitzroy Square, (German Clock Vender). They keep excellent time when regulated. I have one that has not altered a minute for the last six months. They will give the alarm at any time, which may be removed, or put on at pleasure, without impeding the clock's motion. P. H D.

## TO CORRESPONDENTS.

M. N.'s Improved Paddle Wheel, *we will find room for.*

*If* Mr. Cowell *will be kind enough to forward the drawing, it shall be inserted.*

C. C. W. *The drawings and descriptions of an* Improved Safety Lamp *and* Pin Drill, *shall appear the first opportunity.*

*The letters of* G. P. P; S. W.; *and* Thos. Mathews *on* Perpetual Motion, *shall be attended to.*

*The letter on* Railway Tunnels, *shall be inserted.*

*We cannot promise immediate insertion to the letter on* Lightning Conductors, *but it shall not be forgotten.*

*The drawing and description of* Payne's Floating Coffer Dam, *shall receive our early attention. Also the plan for rescuing persons from the Ice.*

*The paper on the* Fly Wheel *will most probably be inserted.*

A Birmingham Mechanic. *The work referred to may be obtained, at the reduced price of 8s. 6d. through the medium of our Printer, opposite* Palmer Terrace, Holloway Road.

*The letter on the* New School of Design, *shall appear next week.*

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# THE PENNY MECHANIC.

A MAGAZINE OF THE ARTS AND SCIENCES.

No. XXXIV.] SATURDAY, JUNE 17, 1837. Vol. 1.

STEAM BOAT EXPLOSION.



Holloway Press: D. A. Doudney

## STEAM BOILER EXPLOSURE.

### ACCIDENT AT HULL.

Considering the immense number of steam vessels that are employed in this country for the purpose of voyaging, it will no doubt appear surprising to persons not well acquainted with the mechanism of the steam-engine, that accidents of any importance so seldom occur. It is a grand example of the intellectual power of man that he can regulate and control one of the most powerful forces yet discovered —that it can be made to minister to all his wants, and afford him pleasures far surpassing even many of those described in Eastern Fables. This giant power, however, sometimes shows its strength, tearing and destroying in its fury all the trammels by which its power had been confined, and producing a scene of devastation and misery that can only be imagined by those who have witnessed such occurrences. A frightful case of this kind has lately occurred. The Union, steamer, which plies between Hull and Gainsborough, on Wednesday morning, the seventh instant, was just on the point of starting from Hull, when on a sudden the boiler burst. The sides of the vessel were instantly torn asunder, fragments of the boiler and engine were scattered with a prodigious force, in all directions, and splinters of the deck, and portions of the luggage, with the mutilated remains of the unfortunate persons who happened to be on board at the time of the accident, were hurled into the water and on the shore, wounding those who happened to be near, and who had avoided being scalded by the steam as it escaped.

For the following additional particulars of the accident we are indebted to our excellent contemporary "The Guide," one of the cheapest and best newspapers published. The explosion took place at five minutes past six o'clock in the morning, and as the vessel was just on the point of starting, nearly all the passengers, as well as many of their friends, were on board. It is calculated that not less than sixty persons were in the fore and after cabins: most of whom were drowned. The report caused by the explosion was of the most frightful nature, and was heard at a most incredible distance from the place where the accident happened. The violence of the explosion may be imagined from the following circumstances. A porter, in the employ of the Dock Company, who was on board, was blown an immense height into the air, and fell on the top of a house three stories high. His mutilated remains rolled down the gable end of the roof to the spout, from whence he had to be taken down; of course he was dead. Mr. Chatterton, an extensive brewer of Hull, was sent with great violence across the jetty, against the yard arms of the Albatros steamer, which was lying on the other side of the pier, and he then fell on the gratings of that vessel. On being picked up he was found to be a corpse, his head being fractured in a dreadful manner. A great number of other persons which happened to be on deck were killed by being thrown with great violence to a considerable distance. A two-stone weight was thrown over the ends of the houses into Wellington-street, a distance of not less than seventy yards; several bags of flour, weighing twenty stones each, were forced into the air, a very great height; and a truss of goods, which had been blown up, fell with such violence into the slated roof of an adjoining house as to break it in.

The cause of the explosion has not been clearly ascertained, but one of the very few persons who escaped, a Mr. Taylor, states that from the sound produced by the passage of the steam through the safety-valve at the time he entered the vessel, he is convinced that there was not sufficient water in the boiler. We have no doubt on our own mind that this was the cause of the accident. An explosion of a boiler may proceed either from the steam within it obtaining a greater expansive force than the boiler will bear; or it may take place in consequence of the decomposition of the water, by which a highly explosive gas is generated, which is sufficient to produce all the effects we have just described.

An explosion from the first of these causes will not take place if proper attention is paid to the safety-valve. This valve is intended to prevent accidents of this kind. It opens outwards, and is kept pressed down by a weight, which is regulated according to the strength of the boiler, so that the force that is sufficient to raise the valve and allow the steam to escape, is much less than what would be required to burst the boiler; whenever, therefore, the steam acquires a certain pressure the valve opens and the steam blows off. All danger of explosion is thus prevented. It frequently happens, however, that the valve gets out of order; it may be loaded too heavily, when of course it is useless. It is customary to have a second safety valve in large boilers, particularly in those of steam-boats; and this valve is inclosed in a box, and locked up, in order to prevent persons meddling with it, and to prevent accident in case

the other valve should get out of order. Notwithstanding these precautions, however, accidents do occasionally take place, although they are seldom or never attended with such disasterous consequences as those that are produced from the cause we are about to describe.

Water is composed of oxygen and hydrogen gases, mixed together in a certain proportion, and when water is suddenly exposed to great heat it is decomposed into these gases: and if a light be then introduced into the mixture, it explodes with great noise and violence. It is this mixture of the gases that is used in producing the very brilliant light that is used for the oxyhydrogen microscope, with which most of our readers are no doubt familiar. Now, if a boiler is allowed to become nearly empty, the fire will cause those parts of it not covered by the water, and exposed to the action of the fire, to become red hot, and directly any motion of the vessel brings a portion of the water into contact with this red hot surface, the water either immediately flashes into steam, of immense power, or is decomposed, and the dangerous gaseous mixture we have described is formed, and explodes; the result is the destruction of the boiler, and every thing surrounding. Mr. Douglas, the inventor and patentee of a steam boiler intended to prevent these accidents, in his letter on the subject in our 32nd Number, page 250, says, "the formation of the explosive gases is the cause of all the explosions of steam-boilers, *and not steam*, as erroneously imagined." Mr. Douglas has had much experience on this subject, and is entitled therefore to be considered as an authority, and in the present instance, from the tremendous force with which the boiler burst, there can be no doubt that the accident was occasioned by the explosion of the mixed gases, produced by the decomposition of the water. We think great blame must attach to somebody. To have so little water in the boiler just before starting shows great negligence. It is necessary that a boiler should contain four or five times as much water as what is converted into steam every hour, and if this is not attended to there is constant danger of accident. It would perhaps be unfair to say any thing more at present respecting the conduct of the engineer, but we hope the accident will be the means of drawing the attention of the profession to the many proposed improvements in steam-boilers, some of which we are sure might be adopted with advantage. One of these improvements is described in Number 7, of the *Penny Mechanic*, to which we beg to refer our readers.

## THE STEAM ENGINE.

NO. IX.

In physical science discovery has always been progressive. We have instances, it is true, in which this appears not to have been the case—where the most trifling circumstance has been sufficient to excite in the mind of a philosopher a train of thought that led him onwards to discoveries the most brilliant and unexpected that could be imagined. The well-known manner in which it is said Newton was first led to a perfect understanding of the principle of gravity, might be adduced as an example: but though the falling of an apple might be the immediate cause of the wonderful discovery that will immortalize his name for ever, yet, had it not been for the laborious exertions of preceding philosophers, who had carefully noted down and accumulated a vast number of facts, which it only required the theory of Newton to explain, he never could have made the discovery he did. If we search the annals of every science, we shall find in all, that before any grand discovery of an unknown law took place —before any phenomena the cause of which was unknown, was clearly explained—that a number of facts had been accumulated—a number of observations had been made, and *then* the master mind arose, some surpassing intellect who perceived the connecting links of the chain by which these apparently isolated facts were connected together, and who grasping in his capacious mind the *rationale* of the whole, propounded the laws to which they were all subject, and which they all obeyed.

In the History of the Steam-engine we have an illustration of these remarks. We have seen how gradually the stock of knowledge relating to the wondrous machine was accumulated; how gradually the engine was improved; and how on a sudden the genius of Watt burst forth, and converted what had previously been little more than a philosophical toy, into one of the mightiest agents for human improvement that has ever been employed. In his mind's eye Watt perceived even more than the poet ever did. His imagination acting on the materials that had been provided by those who had preceded him, enabled him to design and execute the various improvements in the old steam machinery which really *made* the steam-engine, and to obtain for himself a name more glorious than has ever yet been gained by warrior or by statesman, and that will endure as long as mankind shall remember their greatest benefactors, or appreciate that civilization which the steam-

engine has done so much to diffuse, and will be the chief means of extending and preserving.

The great fault of the atmospheric-engine, described in our last paper on this subject, was that it required an enormous quantity of fuel in order to keep it in proper action. This will perhaps be best understood by referring to the common glass atmospheric apparatus. The principal on which it acts is the same as that of the atmospheric-engine. The water in which is converted into steam by the heat of the spirit-lamp, and accordingly drives up the piston rod. Before this can take place, however, it is necessary that the cylinder itself should be raised to the same temperature as the steam, otherwise it would condense the steam into water. When we remove our finger from the top of the piston, and allow the steam to escape, as the piston-rod in this instrument is made hollow, the pressure of the atmosphere drives the rod down, and at the same time cools the cylinder. In the atmospheric-engine the descent of the piston was accomplished by injecting a quantity of water into the cylinder, by which means the steam was condensed. As water when relieved from the pressure of the atmosphere will boil at a temperature considerably below the ordinary boiling point of 212°; it was soon found that the condensing jet was not sufficient to prevent the formation of a vapour that impeded the descent of the piston; and accordingly a sufficient quantity of cold water was obliged to be introduced in order to cool the cylinder and condense the steam below 100°. The waste of fuel from these causes will at once be understood. A great quantity of steam was wasted in heating the cylinder before an effective stroke could be obtained, and then the cylinder was obliged to be cooled so much that the process of heating it had to be effected every time the piston was raised.

In 1763, Watt, who was a mathematical instrument maker to the University of Glasgow, received a model from the Natural Philosophy class, of an atmospheric steam-engine that they required to be repaired. He had previously had his attention directed to the steam-engine by Dr. Robison, but experienced so many difficulties in attempting to improve it, that he had neglected it for other more important occupations. Now, however, that he had the opportunity of experimenting upon an atmospheric-engine, he did not fail to do so, and being wiser from his previous unsuccessful attempts, he conducted his experiment with more skill. The first circumstance that attracted his attention was the one just noticed; the great waste of steam in working the engine. This he attempted to remedy by constructing the cylinder of materials that were bad conductors of heat, such as hard baked wood soaked in oil, &c. He soon, however, perceived, on considering the structure of the engine, and the circumstances under which it worked, as we have just described them, that it could not be made to ac-efficiently without a very great waste of steam. After reflecting on the matter attentively, it occurred to Watt that this inconvenience might be remedied if the steam were condensed in some other vessel than the cylinder. In this case the *cylinder* might always be maintained at a temperature that would not condense the steam, while the *condenser* itself could be kept cool, and thus effect the object required without its being necessary to make any change in the temperature of the cylinder. For this purpose Watt proposed to provide the engine with a separate vessel, to which an air pump should be attached, so that a vacuum might be produced in it. This condensing vessel was to be connected with the cylinder by a pipe supplied with a stop-cock, and whenever this cock was opened, of course the steam would rush out of the cylinder to fill the vacuum in the condensing vessel. This vessel was kept at a low temperature, being surrounded with cold water; and a jet of cold water was also forced into it every time the steam was admitted. By these means the steam was immediately condensed, and thus one grand improvement in the working of the engine was accomplished. Watt states that directly the idea of condensing the steam in a separate vessel occurred to him, the other details suggested themselves so quickly that he was enabled at once to submit his speculations to the test of experiment. A second improvement was made almost simultaneously with the first. As the steam was condensed of course water accumulated in the condenser; and a quantity of air entering along with the condensing jet, prevented in some measure the descent of the piston; it was necessary therefore to have some mode of removing both the water and the air as fast as it accumulated. To effect this, Watt added an air pump to the engine,—it was fitted to the condenser, and the piston of the pump being made to rise and fall by the motion of the beam, a very good vacuum was constantly kept within the condenser, which by means of the cold water surrounding it, condensed the steam directly it entered, and an immense saving of fuel was thus effected.

### FIRE ESCAPES.

*To the Editor of the* PENNY MECHANIC.

SIR,—The establishment of the society for the preservation of life from fire, I consider must have proceeded from the best of motives, and its exertions are most laudable; what I am going to write is therefore with the most friendly intention. The institution like most societies at their commencement, must have so much to learn, as well as teach, that I make so bold as to throw out some hints on that subject. One of its objects is to call forth the ingenuity of persons to invent machines for the purpose. Should not the society by every possible means encourage persons to bring forward their contrivances, and try them in comparison with what the society possesses? Should they not appoint one person in particular, as the maker of their machines who sympathised with the institution, and who would receive such notices as occurred to persons on the subject? Should they not make regular reports as to the merits or defects of the contrivances, how far they are superior, or if superior at all, to a common ladder? Otherwise they may place reliance on machines, rather because they are ingenious, than applicable. Should they not have a place of deposit for all models? Should they not have a quarterly lecture on the subject, and require a certain number of the police from each district of the city to attend them? One of the desiderata in these matters seems to be that the contrivances should be moveable with facility, as a few minutes sometimes are of consequence. The most simple contrivance known which may be carried by one man, is a rope and a pole, so put it up to a person's window from the street. It may be said a woman would not think of coming down by such means; that may possibly be the case, but that is no reason why such an apparatus should not be at hand, for there are men that would avail themselves of such means, and possibly some women, as I saw an account of a woman who saved her life by coming down by aid of the water-pipe. Another contrivance I consider very simple and easily carried to be put up to a window by means of a pole, and so tie a long canvas bag, such as you see made use of for carrying a circulation of air in the holds of ships. To make it strong enough, there must be run in the canvas, lengthwise, strong cord, or lines. Now it appears to me if such a canvas tube, (if I may use the expression) were fastened to a bedstead in a three-story room, a person in letting himself down in it, would have this advantage over a rope, that the canvas could not slip through his hands, and his feet and knees would have hold of the canvas to regulate his descent; besides if persons held the bottom of the canvas from the ground, a dog might be thrown down without danger, as an experiment.

C. W.

### A FIRE-PROOF DRESS.

A Signor Sebastiano Botturi, from Brescia, in Italy, on Thursday exhibited a fire-proof dress, in which he enveloped himself, and passed through a small cottage or shed, erected for the occasion, in the grounds of Cremorne-house, and set on fire for the purpose of proving the incombustibility of his invention. The shed was constructed of thin wood and spars, and crammed with straw and dry chips. The experiment was advertised to take place at half-past three, but it was half-past five before the shed could be prevailed upon to blaze with sufficient fury for the proof of his salamander-like qualifications. The Signor, when clothed in his fire-proof habiliments, bore some resemblance to a Polar bear on its hind legs; his head was covered with a curious kind of gear, something like a conical cap; it had two glass eyes, or rather windows, which glared without speculation on the company. There was also a snout or chimney for the purpose of respiration. This last apparatus made the whole a most grotesque exhibition. The dress was plastered with a sort of compound resembling a mixture of grease and mortar, but, as this is the secret of the contrivance, it is impossible to describe what it really was. As soon as the flames had sufficiently seized on the shed, the Signor boldly entered at one end, and made his exit at another, repeating this feat several times without injury.—*Times.*

## SCIENTIFIC JOURNALS.

*The London and Edinburgh Philosophical Magazine for June* 1837.

THE greater portion of the present Number is occupied with papers on subjects connected with Galvinism and Electricity. One by Dr. Andrews "on the thermo-electric currents developed between metals and fused salts," contains an account of some very interesting experiments that have been made by the writer, in illustration of the subject. A paper by Mr. A. Essex, on the art of painting in enamel will also be found to deserve an attentive

perusal: the whole process is well described. The writer remarks that the power of resisting decay, renders enamel a valuable medium for conveying down the stream of time the likenesses of celebrated individuals. Some rude specimens of vitrified colours have been found in Egypt, which have existed between two and three thousand years, but which still appears as fresh as if they were but the production of yesterday. Portraits, whether executed in oil or in water colours, change in a comparatively short period, the rosy tint, becoming pale, and the high tint, sallow; and where the delicate transparent tints shed their deepening beauty, opacity gradually supervenes. But those which are fixed in enamel will carry on unchanged, to a period indefinitely remote, the most delicate as well as the richest tints originally imported by the artists; and as he left the portrait of the sage, the poet, the warrior, and the beauty, so will they remain, when even the marble which pourtrayed their forms, or told their history, may have crumbled into dust. The botanist will find two short articles of much interest; one "on the supposed absorbent powers of the cellular points or spongioles, of the roots of trees, and plants;" and the other on "the rise of the sap." M. Dutrochet, if we mistake not, first gave weight to the opinion that the nutriment which trees and plants derive from the soil in which they grow, is taken up exclusively by the cellular extremities of their roots, which from their texture have been called spongioles. The theory of Endosmose and Exosmose, or the supposed explanation of the peculiar circumstances connected with the absorbent power of organized membranes, depend in a great measure for support on the imagined absorbent power of these spongioles; but in the paper before us, Mr. Knight denies that they do absorb, and says that from a great variety of experiments he is led to believe it is through the albumham alone that the ascending sap passes, and as spongioles do not contain albunious fibre, they exercise no influence whatever. There are several articles of information connected with chemical science in the present Number, but we have not space to notice them at length.

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*The Repertory of Patent Inventions.*

This excellent work maintains the high reputation it has deservedly acquired as a journal of scientific information. The present Number contains specifications, well illustrated, of seven patents, besides much useful intelligence. The first patent described is that granted to Mr. John Pickergill, for an improved method of applying Indian-rubber to fabrics. According to the ordinary method of making water and air-proof fabrics by the aid of Indian-rubber, whether laid in a thin layer or coating, on one side of a fabric, or a surface of Indian-rubber, between two thicknesses of fabric, the same has been performed by dissolving Indian-rubber, by means of naptha, or other chemical solvents, which bringing the Indian-rubber into a fluid state, it is spread over the fabric to be rendered waterproof; and when the same is intended to be a layer of Indian-rubber, between the two surfaces of fabric, the fabrics being covered by a brush or similar means, with the dissolved Indian-rubber are stuck together by pressure. The object of the invention is the preparing Indian-rubber by rolling it into thin sheets, and applying them to the surfaces of fabrics, that the same may be rendered air and water-proof without the aid of solvents. The inventor also proposes to apply colouring matter to the Indian-rubber, by which it will not only be coloured, but its sticking properties also be prevented, and the Indian-rubber may then be used without any covering or lining. The above invention if found to answer will probably supersede in a great measure Macintoch's patent cloth. There is also a description of Messrs. Scott and Oliver's patent for an improvement in the manufacture of hats and bonnets. It consists in the formation of a contracting and expanding frame formed of wire or whalebone, which is attached to the inside of the hat, and is so constructed as to permit the crown to be compressed or folded down towards the brim, and of being again expanded to the original hat or bonnet shape when required. The expanding and contracting frames consist of two rings, one of which is sewed to the crown of the hat, and the other, which is of an oval form adapted to the head of the wearer, is sewed to the lower part or brim. Four or more uprights are affixed to these rings by joints, and they have also joints near the middle, which permit the uprights to fold inside the rings. A ring or circle of metal having slight curvatures in it, corresponding with the upright, is sewed into the lining of the hat, forming a moveable crown by which the hat is retained in the proper shape or compressed at pleasure. In the present Number there are also the specifications of Mr. Clay, for an improvement in manufacturing sulphate of soda, by condensing the muriatic acid, disengaged by the de-

composition of salt with sulphuric acid, in open or reverberatory furnaces—also of Mr. Buchanan's for an improved apparatus for dying—Mr. Ruthven's for a new method of forming rails for railways; and of Mr. Parke's for improvements in flat pit chains.

*Louden's Magazine of Natural History.*

The articles in the present Number will be more interesting to the naturalist than the general reader. In a paper "on the existence of electrical currents in vegetable structure," the writer adduces a number of facts to show that electrical currents are developed during germination, and that their influence is necessary to the proper performance of that process. An article on the preservation of botanical specimens from the attacks of insects will interest the botanist. The author from experience considers that washing the specimens with a solution of corrosive sublimate is the best preventive.

## MISCELLANIES.

*Steam Engine Crank.*—A correspondent "T. M." in the course of a letter on Perpetual Motion, which we cannot spare room to insert, makes the following observations on the crank.—Among the many improvements which has been introduced into the steam-engine of late years, no inventor has ever made any effectual improvement in the crank, which communicates motion to machinery. It is well known that land-engines require a ponderous fly-wheel to carry the crank past the "dead centres," and so continue the revolving motion. I will brave that species of ridicule which "Z. W." complains of in order to elicit information, by asserting that the full power of a single engine upon the crank does not exceed one-third of its revolution. And that the power of double engines with two cranks at right angles; to such as propel steam vessels, does not exceed two-thirds of the revolution. I have been induced to offer the above observations in consequence of the friendly invitation you give to working mechanics to try their pen and brains in these discussions; notwithstanding their untutored, or "unrefined style of composition," and beg to conclude by putting the following question. If a steam vessel with two engines of fifty-horse power each, will go at the rate of fifteen miles an hour, with the cranks as at present in use, what power of (single) engine would it require to drive the same vessel, at the same rate, providing the full power of the engine could be brought to bare with equal force upon every part of the revolution of the crank?

## INSTITUTIONS.

*London Mechanics' Institution.*—The usual quarterly meeting of the members of this Institution took place on Wednesday evening. Dr. Clutterbuck, V. P., in the chair. After the minutes of the last quarterly meeting had been read, a discussion ensued before they were allowed to be confirmed, in consequence of some remarks that were made by a little gentleman, with a very shrill voice, and who appeared to be rather at a loss occasionally what to say. It was difficult to catch the purport of his observations, in consequence of the coughing, laughter, and hisses with which they were received; but it seemed that he made a charge against a gentleman on the platform, whose answer to it was received with much cheering. The sharp speech of the little gentleman did not appear to have its intended effect of making Mr. Guthrie angry. After the minutes had been confirmed the Committee presented their report, by which it appeared that during the past quarter 296 new members had joined the Institution, and that the present number was 1243. The expenditure during the quarter had amounted to 440l. 12s. 6d., and there was 199l. 2s. owing by the Institution. The expenses of the quarter were 460l. 1s. 8d. The receipts of the quarter had been 436l. 17s. 2d. The balance in the hands of the bankers at the commencement was 109l. 7s. 1d. There was therefore a balance in the hands of the bankers at the present time of 105l. 11s. 9d., and 10l. in the hands of the Secretary. We are sorry to perceive that of the number of members who subscribe to this Institution, there are only *four* ladies. The number of single lecture tickets sold amounted to 94. After the Report had been received, a proposition was brought before the meeting, of which the object was to prevent members under eighteen years of age taking part in the government of the Institution. This measure, it was stated, was almost forced upon those who brought it forward, in consequence of the very indecorous manner in which the younger members had lately conducted themselves. The subject has frequently been a cause of complaint by the older members, and has lately attracted the attention of all who wish the Institution to prosper. In the "London

Magazine," a journal of Educational Institutions, for the last month, we were sorry to perceive the following paragraph:—"There are a great many little boys who subscribe to this Institution, and do not know how to behave themselves properly. Before and after the lecture, and frequently during its delivery, they annoy the other portion of the audience by making a very unbecoming noise; and we are sure that a stranger attending a lecture, and witnessing this conduct, would form a very unfavourable idea of the Institution. We hope the Committee will be able to put an end to the nuisance." A book has been opened by order of the Committee, in which workmen out of place can register their names; and masters will thus have the opportunity of procuring assistants without trouble. Every young mechanic in London who can afford to spend six shillings a quarter for his education, ought to subscribe to this excellent Institution. The Meeting is adjourned till the 26th July.—*(From a Correspondent.)*

### LECTURES DURING THE WEEK.

*London Mechanics' Institution*, Southampton-buildings, Chancery-lane.—Wednesday, June 21, Colonel Thompson, M. P., on Free Trade.—Friday, 23, N, F. Zaba, esq., on the Literature of Poland, both at half-past eight.

*Western Literary and Scientific Institution*, 47, Leicester-square.—Thursday, June 22, N. F. Zaba, esq., on the Literature of Poland, at half-past eight.

*Aldersgate-street Institution*—Wednesday, June 21, T. King, esq., on the Nervous System of Man, at eight.

*Poplar Institution*, East India Road—Tuesday, June 20, C. R. Pemberton, esq., V. P. of the Institution, on the Philosophy of Shakspeare, at eight.

*Mechanics' Institution*, New Road, near Gower Street.—Tuesday, June 20, Mr. J. F. Holdenesse, jun., on the Fundamental Principle of Phrenology, at eight.

*Finsbury Mutual Instruction Society.*—Tuesday, June 20, Mr. Collis, on the Atmosphere, at half-past eight.

### ANSWERS TO QUERIES.

*Receipt for Colouring Ivory.*—To cause the ivory to imbibe the colouring matter it should be boiled in clear water, containing equal portions of nitre and sulphate of iron; whilst hot it should be immersed in the following dye:—Soak powdered fernambuc (Brazil wood) in alcohol, and when the liquid has acquired a sufficient intensity of colour, immerse the ivory; the dye will penetrate considerably in a very short time. Or, by another method,—Boil, in common water, the shearing of scarlet cloth; when it begins to boil throw in a little pearl-ash, which will disengage the colour from the wool, and tinge the water a deep red; you then add a little alum, and strain the mixture to free it from the wool. Before dipping the ivory in this mixture it will be necessary to plunge it (for a moment only) in nitric acid, weakened with water.

P. H. D.

ADVERTISENT.—LONDON MECHANICS' INSTITUTION.—LECTURES.

Mr. T. Phillips, on Vocal Music in Dramatic Effects, with Select Scenes, assisted by the Misses Brandon; June 9.

Colonel P. Thompson, M. P., on National Economy, Free Trade, the Corn Laws, and Currency; June 14, 21, 28, and July 5.

J. Pereira, Esq., on Vision, Physical History of Light considered in relation to Physiology, &c., June 30; and on Hearing, Nature and Qualities of Sound, July 7.

Basil Montagu, Esq., on the "Patriot and Demagogue," July 12.

Basil Montagu, Esq. on Government, July 19.

Professor Calvert, on Elocution, and the Art of Reading, July 14, 21, 28, and August 4.

Mr. Ogilvie, on the Nature and Properties of Water, July 26.

T. Webster, Esq., on Geology, August 2, 9, 16, and 23.

J. Hemming, Esq., on Chemistry, August 11, 18, and 25.

Dr. Birkbeck, on the Muscles and Muscular Motion, August 30.

Subscription twenty-four shillings yearly, or six shillings quarterly, with 2s 6d. entrance. Tickets for the evening, one shilling each.

A Prospectus, giving full particulars, may be obtained at the Institution.

ANDREW M'FARLANE, Secretary.

No. 29, Southampton-buildings,
Chancery-lane, June 7, 1837.

### TO CORRESPONDENTS.

S. W. *will perceive what we have said in the present Number respecting Explosions of Steam Boilers. We shall be glad to hear of his proposed "remedy."*

C. M.'s *suggestion shall not be forgotten. His paper must stand over for a short time, till we come to a determination on the subject.*

China *and* A Constant Reader. *The two last pages of Number* 32, *containing the Advertisements, can be cut off when the work is bound up: they were inserted* as Advertisements, *not as a part of the Magazine*

*The nearest approach to Perpetual Motion, by* Brack himself, *shall appear.*

Mr. Gredley's *drawing and description of* an Alarum, *shall appear in an early Number*

*We have not been able yet to give proper attention to the communication of* M. N. *on* an Improved Paddle Wheel.—C. H. S. on Aerostation—*and* F. V. E. on Cheap Electrical Apparatus. *We will do so by next Week.*

*The letter referred to by* M. J. a Frenchman and Constant Reader *will be very acceptable The translation will save trouble, but if in the original it will be no objection.*

Mr. Cowell's *Letter and Drawing shall be inserted very probably next week.*

*Accepted* P. H. D.—D. J.—W B. Haynes.—J. Johnson.—*and* A. W.

*Received* Brack's Brother.—Query for N. N.—*And* Mechanicus.

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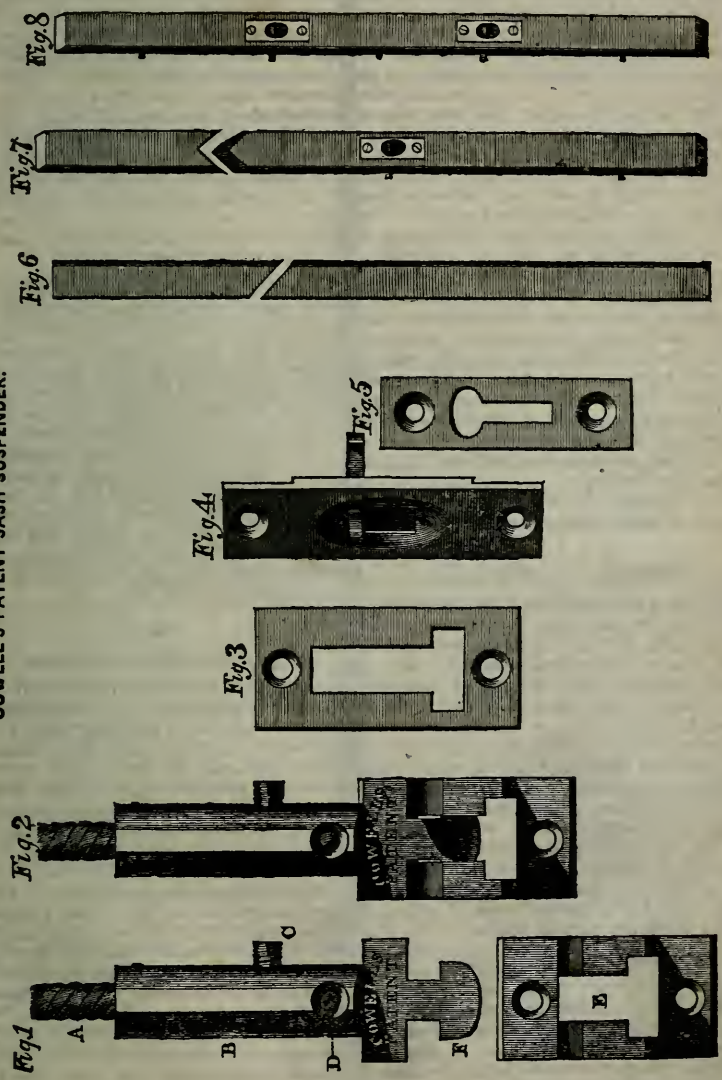
# THE PENNY MECHANIC.

A MAGAZINE OF THE ARTS AND SCIENCES.

No. XXXV.] SATURDAY, JUNE 24, 1837. [Vol. I.


COWELL'S PATENT SASH SUSPENDER.




Holloway Press: D. A. Doudney.

## COWELL'S PATENT SASH SUSPENDERS.

*To the Editor of the Penny Mechanic.*

SIR,—In your Number 26, you were pleased to publish a letter I addressed to you on the subject of my "Patent Sash Suspender," an invention for preventing accidents from window cleaning. I now send you a drawing of the same with description, and full particulars for fixing, that your readers—as other plans are proposed—may be able by comparison to judge as to the best method of effecting so desirable an object. The expense of mine being but a few pence (viz. in iron only four-pence half-penny each) will I think convince the most captious that their ingenuity can only be profitably exercised by an attempt to discover a more perfect instead of a *make-shift sort of plan.* It will at once be seen that the principle I have adopted is of the most simple description—there is no part of it that can possibly get out of order, nor be easily broken or lost, as might be the case with a dovetail wedge, suggested by your correspondent Mr. Morton, to replace which would require a carpenter, and consequently incur an expense equal to a set of my suspenders for a pair of sashes. Confident that this and other objections to the plan alluded to have not escaped your observation,

I remain Your obliged
And Obedient Servant,
H. B. COWELL.

### DESCRIPTION OF ENGRAVING.

Fig. 1, A the sash line, B the socket that receives the sash line, C the screw that presses the spring within to secure the line, D an aperture to show that the line is at the bottom of the socket, E a plate, or eye, to be let into the sash to receive the hook F. Fig. 2, shows the hook F and plate E attached. Fig. 3, a plate to be let into the sash frame, at a convenient height, to receive the hook F fig. 1, when shifted from the sash, to prevent its running up to the pully out of reach. Fig. 4, a flush bolt to be let into the bead to fix it instead of nailing. Fig. 5, a plate to be let into the sash frame for the bolt to lock into. Fig. 6, the parting bead. Fig. 7 and 8, the 5-8ths, or outside bead.

### DIRECTIONS FOR FIXING.

Insert the end of the sash line into socket B fig. 1, when seen at D, turn the screw C. Sink plate E into the end of the sash, above where the line is usually nailed, and mortice sufficiently to admit the whole fig. 2, to lay flush; the top of socket B may come within one inch of the Pully. Let a plate (fig. 3,) into each side of the sash frame to receive the kook F, (fig. 1) when shifted from the sash; one plate is made to accommodate two suspenders, holding them both within reach until they are again wanted; they may be placed about eight inches above the meeting rails of the sashes. Cut parting bead, as shown, fig. 6, so that two-thirds take out and in, fixing in its place the top piece with brads. Cut five-eights or outer bead as shown, fig. 7, fixing the upper portion; three-fourths of this bead (say the one on the left hand) must be moveable; one dowell about nine inches from the bottom, and one bolt fig. 4 a little above the centre, will fix it as firmly as nailing; if the whole of the bead be made to shift, three dowells and two bolts must be employed as seen in fig. 8; this mode is preferable for parlours and drawing-rooms as no joint is then seen.

[We have before alluded to Mr. Cowell's very useful and ingenious invention; but now that our readers have the opportunity of judging whether it deserves the praise we bestowed upon it, we cannot forbear remarking that those who think so should do what lies in their power to make the invention publicly known. The price charged for the "sash suspenders" is so exceedingly low, that the patentee can never be remunerated for his trouble unless they are generally adopted, which, however, we have no doubt will be the case, as they are so very simple in their construction, and calculated to effect so much good.—ED. P. M.]

## UNFORTUNATE INVENTORS.

THE readers of the PENNY MECHANIC must frequently have heard of unfortunate speculators, who, after devoting years of toil and study, and spending large sums of money in order to bring some favorite scheme to perfection, are at last obliged to endure the bitter disappointment of having all their exertions neglected, or treated with contempt. We have no doubt our readers must occasionally have heard of these unfortunate speculators, but they can hardly form an idea how numerous such persons are. We are often meeting with them, and have observed with pain that the more unlikely any particular invention is of becoming generally useful, and the more hopeless the chance of success, that just in that proportion does the inventor overrate the importance of his project, and devote time and money in abundance in order to bring it to perfection. In some of our back Numbers we

have inserted communications from the writer of the following letter, that illustrate, to a great extent, the remarks just made. It is true that the subject on which he writes is one of much importance; but how melancholy it is to reflect that so much valuable time should have been devoted to one object, when it might have been employed successfully on so many others. We insert Mr. Rough's letter because it is one instance of many that we are acquainted with, where talent, time, and money, have been employed for the public benefit without reward; and also because we hope the letter may draw the attention of some of our readers to the unfortunate condition of the writer, and perhaps be the means of realizing some of his plans.—Ed. P. M.

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### SHIPWRECKS, &c.

*To the Editor of the Penny Mechanic.*

Sir,—Since I sent you my last "on Saving Property by Fire;" and "on Preventing Explosions by Gunpowder," which you obligingly published in the 21st Number of your Penny Mechanic, I have been afflicted with inflammation in the left eye, (of which I have been totally blind forty-five years:) and during five weeks, I could scarcely see with the right. But, even on the bed of death, my wish will be to prevent loss of life and property by fire and shipwreck. I have invented and will send you a description of a boat, which if it strike on a rock, sand-bank, or sunken pile, can be unladen without purchases, and the whole of the crew, passengers, and cargo, saved and safely brought into port. If the boat, or any part of it should fill, without pump it can be instantly cleared. It can be strengthened almost equal to the strength of a solid mass of timber, and it can contain provisions for its crew for six months. It can also contain apparatus for making salt water into fresh; with means of taking fresh fish in abundance: also, apparatus for saving sixty hands at once from a wreck, with wine, and restoratives for the sick and wounded. It will require little or no ballast; if any should be wanted, the kelsen will answer for that purpose. It will demonstrate the practicability of strengthening all merchant ships: and, perhaps men of war, by forming the water casks, provision casks, bales of merchandise, and all the officers, passengers, seamen, and soldiers' baggage, into perfect seagoing boats, or into perfect segments of seagoing boats, by which boats, or segments of boats, the cargoes and crews of most wrecked ships can be saved, and brought without injury to the end of their voyage. When going before the wind, she can be regulated to prevent deep rolling, and, consequently carry more canvas, in proportion to the size of her hull, than any boat now in use.

The danger to which the crews of life-boats, are now, in my opinion unnecessarily exposed, when launching their boats on a lee shore in a heavy gale, will thus, be diminished and perhaps entirely removed, by assistant boats, being always either under weigh, or at anchor to windward. I believe the loss of seamens' lives in endeavouring to get to windward to assist vessels in distress, has never yet been noticed, but by the record of the separate losses, as they occurred! and no writer has yet to my knowledge, called public attention to the practicability of always assisting boats to windward.

To the rich and powerful, the immediate advancement of such a universal object of benevolence, would be an imperishable monument of well-earned fame! To the sordid and avaricious, it would yield a firm foundation, whereon they could raise the structure of future wealth, without risque; and to the British nation it would be an act of justice, that would save the lives of her valiant seamen, whose numerous deaths, have recently filled the cottages of her widows and orphans with famine, and unavailing, unceasing lamentations.

From the liberality of the gentlemen connected with the press, I am led to suppose, that all would cordially unite in the accomplishment of this humane design: and that the obstacles that impeded me, since the seige of New Orleans, would be removed. My physical strength is daily failing, and I know, that my mental energies will soon decay. If I do not bring my works to perfection in a year or two, they will be lost to society for ever: and my last stage will be embittered, not only by want; but, with the consciousness, that I laboured unavailingly all my life, to save life and property from fire and shipwreck. I have done every thing a person situated as I am could do with the pen: but, unaided by the press, it is a feeble instrument: united, however, in the cause of suffering humanity, the strongest prejudices would break down, as snow melts before the sun, and I should feel recompensed for the thirty-six years of study, and the £720 I have expended on the subject. Though late, the 36,000 letters I wrote in fourteen years in London, would be recalled to memory; and a benevolent and enlightened nation,

would encourage me to persevere in perfecting my plans for saving life and property from fire, shipwreck, and inundations, all of which, (my published plans) I am capable of revising and improving.

Yours most respectfully,

MICHAEL ROUGH.

21, *le Earl-street, Seven Dials.*

## RAILWAY TUNNELS.

*To the Editor of the Penny Mechanic.*

SIR,—Should you deem the following few lines worthy of a place in your little, but really valuable Magazine, they are at your service.

On March the 24th last, which was Good Friday, I was induced to take a stroll, and by mere accident directed my steps to the Birmingham Railroad, down which I walked for a considerable distance, till I arrived at the Tunnel, under the Harrow Road, near the Cemetry at Kensel Green; and feeling very desirous of entering it, after some little cavelling with the guard or keeper, I was at last admitted. That day, it may probably be in the memories of the majority of your numerous readers, was excessively cold, being a frost, with occasional sleet, &c. When I entered the tunnel, which was in a very rough and unfinished state, I was somewhat surprised to find it exceedingly damp, and I thought much colder than the surrounding external atmosphere, which of course was the result of an over-abundant supply of humidity, and the total absence of any possible effect from the sun or other external causes to disperse it. On entering further into the tunnel, I was much surprised at the apparent carelessness of the turning of the arch; and I was not alone in my opinion, for many persons who were in the tunnel at the same time, expressed their sentiments similarly. Every change or shift of the centreing was distinctly visible, some being considerably higher and some lower than the rest; and in many places bricks actually projected two or three inches down into the tunnel, as if endeavouring to escape from the crushing of the rest. In fact, as I saw it, it was not at all calculated to inspire any idea of safety, but quite otherwise, and which was further heightened by the projection of the mortar from every crevice, from the action of the frost on the mortar in an excessively humid state which necessarily swells it, and every time the engine passed through shook it down from the crown and sides in showers. I do not say that the tunnel is not safe, but think that the proprietors do not act rightly to themselves by admitting strangers into it in such a state; particularly at this time, when so many accidents have happened at Watford and other tunnels in the course of erection, which may materially tend to increase the aversion of the public generally to travelling through tunnels. They ought not to have been admitted at least till it was cemented over—for I am certain that the tunnel must be cemented over to cover the roughness, as well as to prevent the copious percolation of humidity through the walls—for the bricks are very *porous*, not being of very good quality. On the whole the tunnel may be perfectly safe; but it should be cemented to insure confidence.

The dampness was excessive, the walls in many places actually dripping, and in no small quantity, and the greater part was covered with a good thick coat of hoar frost, and huge clusters of isicles hung from the roof like stalactites, which had a rather curious effect. I also observed one or two plates of iron inserted in the walls for some purpose, completely oxydated—and, judging by present appearances, not long to be relied upon for safety—they were very rapidly decomposing. Great quantities of rain had fallen for some time previous to my visit, and therefore the ground in the vicinity of the tunnel was in, I should say, a maximum state of humidity, so that the average would be much less than when I saw it. If the interior of the tunnel were properly cemented it would prevent all, or nearly all percolation, and consequently prevent dampness; beside adding to the appearance of the tunnel.

The length of the tunnel is inconsiderable, and not very deep under ground, which excited my surprise the more.

I am, Sir,

Yours truly,

JACK'S BROTHER.

[We are of opinion there is not so much danger to be apprehended from the workmanship of the tunnel as Jack's Brother would induce many timid persons to believe. Turning an arch under ground, is not to be performed with the exactness it is done on the surface, where men have day-light and the full use of their limbs. However, it does not follow that none but architects and engineers are capable of discovering errors or danger. Mr. Hunt, the late Member for Preston, discovered the settling of the arches of New London Bridge, which occasioned so much alarm at that time for its safety: and most likely our Correspondent's letter will be read by the gentleman under whose direction the

tunnel was constructed; when, no doubt, should he conceive his character at all affected by it, he will communicate with us; and, we shall feel happy in laying his statement before the public.—Ed. P. M.]

## LIGHT AND VISION.

### NO. II.

The explanation which our knowledge of optical law, affords of the mechanism of the eye, and the process by which vision is performed, is as complete and satisfactory as that of hearing by the propagation of motion through the air. The camera obscura, invented by Baptista Porta in 1560, gave the first idea how the actual images of external objects might be conveyed into the eye, but it was not till after a considerable interval that Kepler, the immortal discoverer of those great laws which regulate the periods and motions of the planets, pointed out distinctly the offices performed by the several parts of the eye in the act of vision. From this to the invention of the telescope and microscope there would seem but a small step, but it is to accident rather than design that it is due; and its re-invention by Galileo, on a mere description of its effects, may serve, among a thousand similar instances, to show that inestimable practical applications lie open to us, if we can only once bring ourselves to conceive their possibility, a lesson which the invention of the achromatic telescope itself, as we have before related it, not less strongly exemplifies. The little instrument with which Galileo's splendid discoveries were made was hardly superior in power to an ordinary finder of the present day; but it was rapidly improved on, and in the hands of Huyghens attained to gigantic dimensions and very great power. It was to obviate the necessity of the enormous length required for these telescopes, and yet secure the same power, that Gregory and Newton devised the reflecting telescope, which has since become a much more powerful instrument than its original inventor probably ever contemplated. The telescope, as it exists at present, with the improvements in its structure and execution which modern artists have effected, must assuredly be ranked among the highest and most refined productions of human art; that in which man has been able to approximate more closely to the workmanship of nature, and which has conferred upon him, if not another sense, at least an exaltation of one already possessed by him that merits almost to be regarded as a new one. Nor does it appear yet to have reached its ultimate perfection, to which indeed it is difficult to assign any bounds, when we take into consideration the wonderful progress which workmanship of every kind is making, and the delicacy, far superior to that of former times, with which materials may now be wrought, as well as the ingenious inventions and combinations which every year is bringing forth for accomplishing the same ends by means hitherto unattempted. After a long torpor, the knowledge of the properties of light began to make fresh progress about the end of the last century, advancing with an accelerated rapidity, which has continued unabated to the present time. The example was set by our late admirable and lamented countryman, Dr. Wollaston, who re-examined and verified the laws of double refraction in Iceland spar announced by Huyghens. Attention being thus drawn to the subject, the geometry of Laplace soon found a means of explaining at least one portion of the mystery of this singular phenomenon, by the Newtonian theory of light, applied under certain supposed conditions; and the reasoning which led him to the result (at that time quite unexpected), may justly be regarded as one of his happiest efforts. The prosecution of the subject, which had now acquired a high degree of interest, was encouraged by the offer of a prize on the part of the French Academy of Sciences; and it was in a memoir which received this honourable reward on that occasion, in 1810, that Malus, a retired officer of engineers in the French army, announced the great discovery of the *polarization of light* by ordinary reflection at the surface of a transparent body. Malus found that when a beam of light is reflected from the surface of such a body at a certain angle, it acquires precisely the same singular property which is impressed upon it in the act of double refraction, and which Newton had before expressed by saying that it possessed *sides*. This was the first circumstance which pointed out a connection between that hitherto mysterious phenomenon and any of the ordinary modifications of light; and it proved ultimately the means of bringing the whole within the limits, if not of a complete explanation, at least of a highly plausible theoretical representation. So true is, in science, the remark of Bacon, that no natural phenomenon can be adequately studied in itself alone, but, to be understood, must be considered as it stands connected with all nature. The new class of phenomena thus disclosed were immediately studied with diligence and success, both abroad by Malus and Arago, and at home by our

countryman Dr. Brewster, and their laws investigated with a care proportioned to their importance; when another and apparently still more extraordinary class of phenomena presented itself in the production of the most vivid and beautiful colours (every way resembling those observed by Newton in thin films of air or liquids, only infinitely more developed and striking,) in certain transparent crystallized substances, when divided into flat plates in particular directions, and exposed in a beam of polarized light. The attentive examination of these colours by Wollaston, Biot, and Arago, but more especially by Brewster, speedily led to the disclosure of a series of optical phenomena so various, so brilliant, and evidently so closely connected with the most important points relating to the intimate structure of crystallized bodies, as to excite the highest interest,—that sort of interest which is raised when we feel we are on the eve of some extraordinary discovery, and expect every moment that some leading fact will turn up, which will throw light on all that appears obscure, and reduce into order all that seems anomalous. This expectation was not disappointed. So long before the time we are speaking of as the first year of the present century, our illustrious countryman, the late Dr. Thomas Young, had established a principle in optics, which, regarded as a physical law, has hardly its equal for beauty, simplicity, and extent of application, in the whole circle of science. Considering the manner in which the vibrations of two musical sounds arriving at once at the ear affect the sense with an impression of sound or silence according as they conspire or oppose each other's effects, he was led to the idea that the same ought to hold good with light as with sound, if the theory which makes light analogous to sound be the true one; and that, therefore, two rays of light, setting off from the same origin, at the same instant, and arriving at the same place by different routes, ought to strengthen or wholly or partially destroy each other's effects according to the difference in length of the routes described by them. That two lights should in any circumstances combine to produce darkness may be considered strange, but is literally true; and it had even been noticed long ago as a singular and unaccountable fact by Grimaldi, in his experiments on the inflection of light. The experimental means by which Dr. Young confirmed this principle, which is known in optics by the name of the *interference* of the rays of light, were as simple and satisfactory as the principle itself is useful; but the verifications of it, drawn from the explanation it affords of phenomena apparently the most remote, are still more so. Newton's colours of thin films were the first phenomena to which its author applied it with full success. Its next remarkable application was to those of diffraction, of which, in the hands of M. Fresnel, a late eminent French geometer, it also furnished a complete explanation, and that, too, in cases to which Newton's hypothesis could not apparently be made to apply, and through a complication of circumstances which might afford a very severe test of any hypothesis. A simple and beautiful experiment on the interferences of polarized light due to Fresnel and Arago enabled them to bring Dr. Young's law to bear on the colours produced by crystallized plates in a polarized beam, and by so doing afforded a key to all the intricacies of these magnificent but complex phenomena. Nothing now was wanting to a rational theory of double refraction but to frame an hypothesis of some mode in which light might be conceived to be propagated through the elastic medium supposed to convey it in such a way as not to be contradictory to any of the facts, nor to the general laws of dynamics. This essential idea, without which every thing that had been before done would have been incomplete, was also furnished by Dr. Young, who, with a sagacity which would have done honour to Newton himself, had declared, that to accommodate the doctrine of Huyghens to the phenomena of polarized light it is necessary to conceive the mode of propagation of a luminous impulse through the ether, differently from that of a sonorous one through the air. In the latter, the particles of the air advance and recede; in the former, those of the ether must be supposed to tremble laterally. Taking this as the groundwork of his reasoning, Fresnel succeeded in erecting on it a theory of polarization and double refraction, so happy in its adaptation to facts, and in the coincidence with experience of results deduced from it by the most intricate analysis, that it is difficult to conceive it unfounded. If it be so, it is at least the most curiously artificial system that science has yet witnessed; and whether it be so or not, so long as it serves to group together in one comprehensive point of view a mass of facts almost infinite in number and variety, to reason from one to another, and to establish analogies and relations between them; on whatever hypothesis it may be founded, or whatever arbitrary assumptions it may

make respecting structures and modes of action, it can never be regarded as other than a most real and important accession to our knowledge. Still, it is by no means impossible that the Newtonian theory of light, if cultivated with equal diligence with the Huyghenian, might lead to an equally plausible explanation of phenomena now regarded as beyond its reach. M. Biot is the author of the hypothesis we have already mentioned of a rotatory motion of the particles of light about their axes. He has employed it only for a very limited purpose; but it might doubtless be carried much farther: and by admitting only the regular emission of the luminous particles at equal intervals of time, and in similar states of motion from the shining body, which does not seem a very forced supposition, all the phenomena of interference at least would be readily enough explained without the admission of an ether.

## ARITHMETICAL PUZZLE.

*To the Editor of the* PENNY MECHANIC.

SIR,—The *severe* criticisms of your Solomon of a correspondent, are quite overwhelming! What profundity of thought! what depth of wisdom! what a superior understanding must he possess! Had it not been for him, probably *the slip of the pen* in my Arithmetical Puzzle, might never have been discovered, and the world would have been left in darkness; I myself, did not perceive it till after it had appeared in print, and wise "W. B." only saved me writing a letter to correct it. How many sleepless nights, and restless days, must it have cost him! And, when at last, the light burst upon his understanding, what joy! what rapture! must he have felt, to have discovered a mistake!—and, not only that, but to have rectified it also! (or it is easier by far to discover mistakes than to rectify them.)

If it is not too much presumption in one of my inferior intellect, I would tell this *light of the world*, whose wisdom far surpasseth that of Solon, that, had I taken the trouble to read over my puzzle a *second* time, I should have put "when there is no remainder, the figure struck out would be either *a nine* or *an ought*." Instead of "when there is no remainder the figure struck out would be a *nine* alone." But perhaps this wise man in the wisdom of his heart might ask, "How are you to know whether it is *nine* or an *ought?*"

This then, O! Solomon, is the way. Ask of the person, to whom you are showing the puzzle, whether the figure he struck off be *odd* or *even*." If odd say *nine*, if even say *ought*. If there *is* a remainder, of course you need not put that question. If Mr. Editor would insert the above explanatory letter, he would much oblige his

Obedient Servant,
SNUBBY GONG.

## MISCELLANIES.

*To remove Ink and Grease Spots.*—Sir,—I send the following, believing it worth insertion in your Mazazine. Nearly all the acids remove spots of ink from paper, but it is important to use such as attack its texture the least. Spirits of salts diluted with five or six times its quantity of water, may be applied with success upon the spot, and after a minute or two, washing it off with clear water. A solution of oxalic, or tartaric acid is attended with the least risk, and may be applied upon the paper, or plates, without fear of damage. These acids for taking out writing ink, and not touching the printing, can be used for restoring books where the margins have been written upon, without attacking the text. When the paper is disfigured with stains of iron, it may be perfectly restored by applying a solution of sulphuret of potash, and afterwards one of oxalic acid. The sulphur extracts from the iron a part of its oxygen, and renders it soluble in diluted acids. The most simple, but at the same time very effectual method of removing spots of grease, wax, oil, or any other fat substance, is by washing the part with ether and placing it between white blotting paper. Then with a hot-iron press above the part stained, and the defect will be speedily removed. In many cases where stains are not bad, rectified spirits of wine will be found to answer the purpose.

I remain Yours, &c.
G. H. M.

*The Hindoostan Lapidaries Wheel.*—This wheel is extremely useful for cutting patterns on glass, engraving on crystal, filing metals, sharpening instruments, and many other purposes besides the work of a lapidary. It is composed of two parts of fine emery powder, and one part of gum-lac. The emery is put into a crucible, and when hot enough to melt the lac, throw in some pieces one by one, stir the whole well, and make the mixture as complete as possible, and then pour it on a smooth marble slab; after beating it well with a pestle, roll it on a stick and heat it again, &c. When the mixture is perfect,

you pour it on the marble slab, (pounced with emery) in a hoop of iron or wood forming a mould, flatten and press in the paste with an iron roller, and smoothen the surface with a piece of iron and emery, heat the iron mandril and pass it through the centre, when cold it is applied to the lath and fit for use. The composition of the wheel is not only durable and simple, but may be less costly if applied as a ring on to the circumference of any other wheel, although generally made solid by the Hindoostan. P. H. D.

*National Baths, Westminster Road.*—We had the pleasure of visiting these baths a few days since, and were much gratified at perceiving, that the threepenny tepid bath, noticed some Numbers back, was now opened, and that the mechanics duly appreciated the advantages it afforded them. It it certainly one of the finest baths in the metropolis.

*The Grand Junction Railway* of Liverpool and Birmingham will be opened to the public, it is confidently expected, in the course of the ensuing month.

*Mail-Coach Drag.* — The new mail-coaches have a piece of machinery attached to the hind part of the mail, for the purpose of locking down the steep hills without the guard's getting down, or, in case of the horses running away down a hill, of stopping the mail instantly. The contrivance is very simple, and is done by the pressure of two pieces of wood against the wheels: the connecting rod going to the top of the coach is turned by a screw, and the effect on the wheels is immediate.

## INSTITUTIONS.

### LECTURES DURING THE WEEK.

*London Mechanics' Institution*, Southampton-buildings, Chancery-lane.—Wednesday, June 28, Colonel Thompson, M. P., on the Corn-Laws. Friday, 30, J. Pereira, esq., on the Senses, both at half-past eight.

*Western Literary and Scientific Institution*, 47, Leicester-square.—Thursday, June 29, N. F. Zaba, esq., on the Literature of Poland, at half-past eight.

*Aldersgate-street Institution*—Wednesday, June 28. T. King, esq., on the Nervous System of Man, at eight.

*Eastern Athenæum.*—Wednesday, June 28, Dr. Birkbeck, V. P. of the Institution, on the Measurement of Time, at eight.

*Poplar Institution*, East India Road.—Tuesday, June 27, Robert Brindley, esq., on Naval Architecture, and the causes of Shipwreck, with Diagrams and illustrations, at eight.

*Mechanics' Institution*, New Road, near Gower Street.—Tuesday, June 27, Mr. Angell, on the Steam-Engine, at eight.

*Kentish Town Mutual Instruction Society.*—Monday, June 26, M. Gregory, on Botany, at half-past eight.

*Finsbury Mutual Instruction Society.*—Tuesday, June 27, Col. Thompson, M. P., on National Economy; The Corn-Laws, &c.—Thursday, 29, A Concert by the Members of the Choral Class and others, at half-past eight.

## QUERIES.

*To the Editor of the Penny Mechanic.*

*Fireworks.—Coloured Fires.*—Sir, — N. N. who has in your last Number of the PENNY MECHANIC answered my Query respecting "Coloured Fires," must know very well, if he has tried the compositions he gives, that neither of them burn like the colours he says they do; I have tried them all, and I find the only one that burns is the Spur Fire, but that is not a coloured fire.

Yours, &c. A. B. Y. Z.

Sir,—I shall be much obliged if some of your readers can inform me, how Park's Fusible Alloy is made, or where it could be bought. Also how Blue Lights are made, such as they use for signals at sea, &c.

Your obedient Servant, D. J.

Sir,—Being engaged in constructing a Phantasmagoria of large powers, I am desirous to dispense with the unsightly appearance of a chimney. If any of your intelligent correspondents will inform me, through the medium of your valuable Periodical, of the best plan for condensing or consuming the smoke, they will oblige your constant reader,

A. M.

## TO CORRESPONDENTS.

A. W. *The Parachute will open without assistance when descending. A solution of Alum will perhaps do.*

D. J. *Any work on Electricity will give him better information on the subject than he could obtain by an answer to his queries.*

J. Johnson. *Hydrogen gas. It may be obtained by pouring a little diluted Sulphuric Acid (oil of vitrol) on a few pieces of granulated zinc in a bottle.*

*Will* A. M. *be kind enough to point out the errors in the drawing, if they are important, not otherwise.*

F. V. E's. *drawing and description of a* cheap Electrical Machine *shall appear in an early Number. It is very ingenious.*

C. H. S. *must condense the matter into a smaller compass than what he mentions.*

*Has* M. N. *got a model of his Paddle Wheel that he could leave with our publisher for a few days in order that we might see it? We are afraid* M. N's *description of the drawing would not be fully comprehended, and we cannot well alter it without seeing the model.*

C. D. Thomas, *next week.*

S. W. *and* A Mechanic, *shall receive our best attention.*

*A report of the Evidence of the Scientific Men examined at the late Inquest at Hull, respecting the cause of the explosion, is unavoidably postponed this week.*

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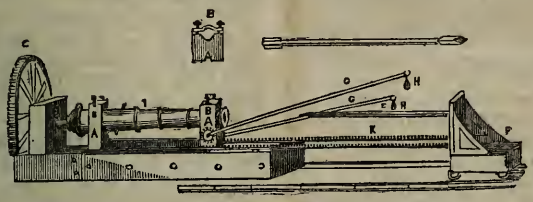
# THE PENNY MECHANIC.

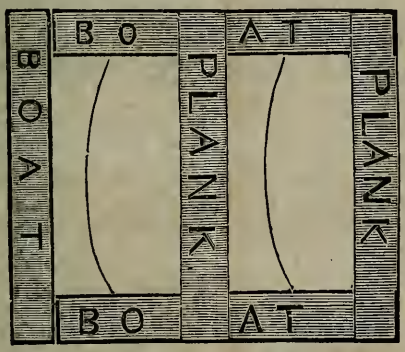
A MAGAZINE OF THE ARTS AND SCIENCES.

No. XXXVI.] SATURDAY, JULY 1, 1837. [Vol. I.

METHOD OF BORING CANNON.—Fig. 1.



MACHINE FOR RESCUING PERSONS FROM THE ICE.—Fig. 2.




IMPROVED SAFETY LAMP.—Fig. 3.

IMPROVED PIN DRILL.—Fig. 4.

Holloway Press: D. A Doudney.

## CASTING AND BORING CANNON.

Fig. 1.

Cannons are cast from wooden models, which have been exactly and smoothly turned at a lathe, so that they may leave the sand with facility during the process of moulding; and as the model does not admit of being drawn from the sand like a smooth cylinder, they are moulded in boxes opening along the sides. The metal is required to be of the best quality, and along with the common sort, it is usual to mix the superior Welsh pig iron, and that drawn from the rich ores of Cumberland.

Every gun, previous to its being bored, is fixed in a stout iron frame between two centre points, and engine-turned all over the outside with sharp steel tools properly fashioned. It is then carried to the boring engine, and placed horizontally in two massy cast-iron supporters, represented in the engraving at A, A, each containing a hollowed brass gully exactly fitting to the gun at the breech and at the neck, and over which the collar B is screwed down, that the piece may revolve steadily. It is then connected with the cog-wheel C by means of a square iron box at D, a square knob of a corresponding size being cast upon the breech of the cannon for this purpose, but which is ultimately cut off. The sharp steel drill E is then brought into contact with the muzzle of the gun, by advancing the carriage F, the front of which, bearing the borer, is a massy metal plate, strengthened by brackets from behind, and resting upon a cube of solid iron about nine feet square, and twelve inches thick, and which moves on small truck wheels along a metal road. Upon the square projecting axles of the cog-wheels on either side of the supports are next placed the levers G, G, and upon these the weights H, H; the gun I is then made to revolve slowly by putting in motion the wheel C. From the sketch it will be obvious, that when the drill is brought into contact with the piece to be bored, and the latter turned round by the machinery, the effect of the levers through the operation of the pinions upon the two racks K, K, must be by maintaining a constant pressure to keep the drill to its work; the levers, meanwhile, as their weights respectively approach the floor, being taken off and replaced at their first elevation till the boring is completed; which, in a thirty-eight pounder, will generally require about forty-eight hours, including two or three stoppages to sharpen the drill. The racks are about twelve feet long, and the other parts of the machinery in proportion; the whole being exceedingly massy, and firmly bound together.

When the gun has been bored to the proper depth by this process, the drill is removed, and another instrument introduced into its place consisting of a shaft of iron, shod at the extremity with four or five square bits of steel, attached by longitudinal groves to the rod. This being introduced, widens the bore about the eighth of an inch, at the same time smoothing and perfecting the calibre to the exact dimensions required.

An idea must naturally present itself to the most indifferent observer, that to cast the guns hollow at once, as it would involve no difficulty, so it would not only facilitate the work, but save a deal of expense consequent on the tedious process of boring the solid metal. This plan has been tried, but abandoned as unsatisfactory; it being found almost impossible thereby to get the inside quite free from flaws; and, as every piece was not only proved at the arsenal, by firing double charges, but examined throughout by the introduction of a spring instrument, called a *searcher*, the core-cast cannon were rejected. Indeed it will be universally admitted, without adverting to the direct and dreadful use of the guns, that too great care cannot be exercised to prevent artillerymen from being unnecessarily endangered by the bursting of imperfect metal.

Happily for the interests of humanity, the business of cannon-casting on the large scale appears to be at an end; the foundery being at present at work chiefly for the arts of peace. Since the introduction of gas, the demand for cast-iron piping has increased amazingly; and it is gratifying thus to reflect that much of the metal which, under other circumstances, might have composed a "devilish enginery" for carrying death through ranks of our fellow-men, is now used for the economical conveyance of the pabulum of illumination through our towns, manufactories, and dwelling-houses.

Some idea of the quantity of cast-iron which at one period was consumed in the article of guns, &c. may be formed from the fact that, about 1795, the average amount of metal purchased by the Board of Ordnance in the state of cannons, mortars, carronades, shot and shells, taking the account of three years, was estimated at nearly 11,000 tons annually. The India company took for a yearly supply about half of that amount, i. e. 5,000 or 6,000 tons; and besides these two items, other armed trading vessels were said to purchase 10,000 tons, making a total of 26,000 tons of iron annually cast into that "devilish enginery," at the explosion of which, so oft, by sea and land, thousands were laid low.

## MACHINE FOR RESCUING DROWNING PERSONS FROM THE ICE.

Fig. 2.

*To the Editor of the* Penny Mechanic.

Sir,—The ingenious contrivance produced by your correspondent "H. P.," page 27, for rescuing persons from the ice, suggested to me the following plan. I must first premise that every apparatus for the same purpose I have ever heard of, (including that of "H. P.'s") is upon the principle of making the persons in the water *help themselves* out by their own strength, which appears to me defective, as means must frequently be required to take out a person too insensible for exertion. Now I believe the following plan would fully answer, even in cases where a sufferer might be drowning *under* the ice without any part of his body being seen; and the machine is so evidently safe for those who are to work it, that when an accident might occur requiring it, the most timid persons would feel no hesitation in conveying it to the sufferer, even if in doing so they had to pass over ice as dangerous as that to which they might be hastening.

The following is an explanation of the drawing. Three boats of wicker work with wooden circular bottoms, are made watertight by a covering of canvass and caoutchouc varnish. The boats are twelve feet long, two feet wide, and four feet deep, and are placed to form three sides of a square, while two planks twelve feet long, a foot-and-a-half broad, and two inches in thickness are placed at equal distances over the tops of the *two parallel boats*; one of the planks forming the fourth side of the square. The two parallel boats have small iron keels to assist their running over the ice; the third has no keel, and while the others are sliding does not touch the ice. Ropes fastened to the two parallel boats hang from one boat to the other, reaching the ice in the centre. This machine in the water would buoy up as many persons as could well lay hold of it, and therefore when an accident occurred, two or three of the nearest bye-standers would be sure to volunteer for the rescue. Arrived at the hole made in the ice, the plank side of the machine, (the side without a boat), is passed over the head of the person in the water if he be visible, and one of the rescuing party, getting on the plank over the hole, helps out the sufferer; but if the body has sunk under the ice, the party immediately set to work with hatchets, and breaking the ice by the sides of the boats, bring out the body dead or alive, without the least risk to themselves, as they are either in the boats or on the planks. If the ice be much broken during the rescue, a rope is flung from the shore, and the machine hauled over the hole either by the party themselves or those on shore.

I am not aware that any similar or better plan than the above has been suggested; but I am quite convinced that no plan will approach it in point of utility which has not a provision for taking bodies out of the water when in a state of insensibity.

Yours, &c.

G. P. P.

## IMPROVED SAFETY LAMP.

Fig. 3.

*To the Editor of the* Penny Mechanic.

Sir,—The following is a description of a Safety Lamp to be used in coal mines, and which I imagine will be an improvement on the Davy Lamp.

DESCRIPTION.

The flamp A is a glass lens round the flame of the lamp, which makes the light stronger; B is a circular piece of iron, with a worm made fast to the wire gauze; C is a lid to screw on the iron. It will be seen that this lamp is calculated to give more light than the common ones, where the wire surrounds the flame. The lid is to be taken off when the lamp requires trimming.

I am, Sir,
Your Subscriber,

C. C. W.

[The glass funnel might have a male screw on each end, and thus be screwed on to the gauze wire above and below the glass.]

## IMPROVED PIN DRILL.

Fig. 4.

*To the Editor of the* Penny Mechanic.

Sir,—I send a description of an improved pin drill, which is used for large lathes with iron beds. This is called a pin drill, from its having a pin at the end of it; as will be seen in the drawing. It is used for drilling large work, when the common drill will not do. This drill is for drilling iron.

DESCRIPTION.

*a* is the cutting parts, *b* is the pin, at the end of which is another drill c, which is my improvement. This drills with the other. Now it will be seen that a great deal of time is saved, for in the old drills the pin is plain, and requires another drill

to be drilled through the work, when sometimes there is not a drill of the size of the pin. The drill at the end of the pin remedies this; it works with the other drill. If you think this worth your notice an insertion will oblige

Your Subscriber,
C. C. W.

## STEAM BOILER EXPLOSION AT HULL.

SINCE our last account of this accident the coroner's inquest has concluded its labours; and the jury have returned a verdict of manslaughter against the engineer. The evidence of the witnesses who were examined for the purpose of ascertaining the cause of the explosion is not satisfactory, but the general opinion appears to be that it was occasioned in consequence of there not being a sufficiency of water in the boiler. One of the witnesses, however, Mr. Lewis, most positively contradicts this; he says, "I tried the gauge taps, which are placed in the boiler to ascertain the height of the water; the first emitted nothing but pure steam; there was no peculiar colour or smell about that steam; the second (the lower tap) let out water, which flowed for I dare say a minute and a half, in consequence of my not being able to turn the cock. Boilers are considered safe when there is water in the lowest tap, and steam in the two top ones. The use of these taps is to keep the water between the top taps and the bottom one. The explosion took place within two minutes of my trying the gauge tap, and from the trial of the taps I should consider the boiler quite safe." Mr. James Overton, of Hull, boiler maker, stated that he had seen the engine and boiler of "the Union" about two months ago; the boiler was then in a sound state, and capable of bearing a pressure of 10lbs. on the square inch; and he considers it might have borne 40lbs. to the square inch without bursting. The safety valves had not a greater resistance than 8lbs. to the square inch. He thinks the cause of the explosion to have been the want of water in the boiler, and that probably the water having been decomposed, and the hydrogen mixed with oxygen from the atmosphere, the explosion of these gases produced the mischief. There is, however, some difficulty in accounting for the presence of a sufficient quantity of oxygen to produce so great an explosion. The atmosphere can hardly be supposed to have passed into the boiler, and hydrogen itself will not explode unless mixed with oxygen. Mr. Vernon, engine manufacturer, stated most positively, that air could not descend through the safety valve when open, if the interior of the boiler were full of gas, because there would be a greater pressure outwards than inwards, but he thought the gas might ignite itself! We think this must be a mistake of the reporter or printer, because when water is decomposed into its elements in a boiler, it is always considered to be in consequence of the iron boiler having a greater affinity for the oxygen of the water than the hydrogen has, and the latter is consequently set at liberty. This is the reason why *copper* boilers would be so much safer, since they would not decompose the water so readily as iron boilers; but there appears to be something inexplicable respecting the mixture of the gases that has always baffled inquiries into the causes of steam-boiler explosions. Mr. Barrett, another engineer, said, "I suppose the explosion in question was occasioned by too small a supply of water being in the boiler, which being exhausted, the tops of the flues became bare, and the fire continuing to act upon them, they became red hot, and then the water was decomposed, and the quantity of steam generated, decreasing, and the act of decomposition increasing; this process would go on till the whole mass became gas; the tops of the flues continuing hot, the gas would become more and more rarified till ignition took place. I cannot determine whether it would ignite without coming into contact with atmospheric air, *I think it would.*" Mr. A. Y. Barrett is of the same opinion. From this evidence it will be perceived that three scientific men think that the explosion might take place *without the admission of atmospheric air into the boiler.* The evidence to show that the generation of high pressure steam was not the cause of the accident, is very strong. Besides the fact that it might have escaped by the safety valve, the manner in which the boiler burst showed that it must have been by some tremendous power suddenly generated. If there had been five times the ordinary pressure on the boiler it would not have burst; it would only have bulged, from the giving way of the stays. Mr. Vernon says that whenever boilers are burst from the force of steam, they are always rent in the weakest part; pieces of the boiler are not detached. He did not think a boiler like that of the Union *could* be burst by steam. Some of the witnesses, however, were of a different opinion. The question relative to the cause of the explosion is still unsettled, but perhaps there may be some further light thrown upon the subject before the trial of the engineer takes place.

## ON AEROSTATION.

NO. I.

In the year 1707, as we are informed by a letter published in France in 1784, a projector, Friar Gusman, applied to the king for encouragement to his invention of a flying machine. The principle, if it had any, seems to have that of a paper kite. The machine was in the form of a bird, and held several tubes through which the wind was to pass, in order to fill a kind of sail, which was to elevate it; and when the wind was deficient the same effect was to be performed by means of bellows concealed within the body of the machine. The ascent was also to be promoted by the electric attraction of pieces of amber placed in the top, and by two spheres inclosing magnets in the same situat on The king to encourage him to proceed, granted a place in his college of Barcelos or Santarem, with first professorship in the University of Coimbra, and an annual pension of 600,000 reis during his life. Of this De Gusman, it is also related, that in the year 1736, he made a wicker basket of about seven or eight feet in diameter, and covered it with paper which raised itself about 200 feet in the air, and the effect was generally attributed to witchcraft.

In the year 1766 Mr. Henry Cavendish ascertained the weight and other properties of inflammable air, determining it to be at least seven times lighter than common air. Soon after which it occurred to Dr. Black, that perhaps a thin bag filled with inflammable air might be buoyed up by the common atmosphere; and he thought of having the allantors of a calf prepared for the purpose, but his other avocations prevented him from prosecuting the experiment. The same occurred to Mr. Cavallo; and he has the honour of being the first who made experiments on the subject. He first tried bladders; but the thinnest of these, well scraped and prepared, was found too heavy. He then tried Chinese paper, but that proved so permeable that the vapour passed through it like water through a sieve. At the same time, on the continent they were not asleep; for in 1782, two brothers, Stephen and John Montgolfier, natives of Annoway, paper manufacturers, turned their thoughts to the subject. The idea was first suggested by the natural ascent of smoke and clouds in the atmosphere, and their design was to form an artificial cloud by inclosing the smoke in a bag, and making it carry up the cover with it. Towards November in that year, it was tried at Avignon with a fine silk bag of a parallelopiped shape. By applying burning paper to the lower aperture the air was rarified, and the bag ascended in the atmosphere, and struck rapidly against the ceiling. On repeating the experiment in the open air, it rose to the height of seventy feet. An experiment on a more extended scale was now projected, and a new machine containing about 650 cubic feet was made, and it rose about 600 feet. An immense bag of linen lined with paper and containing upwards of 23,000 cubic feet was found to have a power of lifting about 500lbs. besides its own weight. The operation was begun by burning chopped straw and wool under the aperture of the machine, which immediately began to swell. One of the brothers constructed a large balloon of an elliptical form at Paris, sixty feet high, and forty feet in diameter. In a prelimanary experiment the machine lifted up from the ground eight persons, and would have carried them off if others had not come to their assistance. The great power of these machines, and their very gradual descent, had originally shown they were capable of transporting people through the air with all imaginable safety: as M. Mongolfier proposed to make a machine of a firmer and better construction, M. Pilatre de Rozier offered himself to be the first aerial adventurer.

This new machine was of an oval shape about forty-eight feet in diameter, and seventy-four feet high, painted outside with the signs of the zodiac cyphers of the king's name, and other ornaments. A proper gallery grate, &c. were appended in the manner afterwards described; so that it was easy for the person who ascended to supply the fire with fuel, and thus keep up the machine as long as he pleased. The weight of the whole apparatus was upwards of 1,600lbs. The experiment was performed on the 15th Oct. 1783: with this machine M. Pilatre in calm weather ascended 210 feet; some time after he ascended with M. Girond de Vitell to the height of 230 feet, hovering over Paris for above nine minutes, the machine keeping perfectly steady. On the 21st of Nov. 1783, M. Pilatre determined to undertake an aerial voyage, in which the machine should be fully set at liberty, it being held with ropes be ore. Every thing being got in readiness, the balloon was filled in a few minutes; and M. Pilatre placed himself in the gallery, counterpoised by the Marquis d'Orlandes, who occupied the other side. They met with no inconvenience during their voyage, which lasted about twenty-five minutes, during which time they had passed over

a space of about five miles. From the account given by the Marquis d'Orlandes, it appears that they met with several different currents of air; the effect of which was to give a very sensible shock to the machine, and the direction of the motion seemed to be from the upper part downwards. It appears also, that they were in some danger of having the balloon burnt altogether, as the Marquis observed several round holes made by the fire in the lower part of it, which alarmed him considerably. The progress of the fire was easily stopped by the application of a wet sponge, and all appearance of danger soon ceased.

C. H. S.

## DOMESTIC WATER MILLS.

*To the Editor of the Penny Mechanic.*

*Lisieux, Normandy, June* 12th.

Sir,—I have received your interesting miscellany at this place, and should I stumble now and then on a good scientific article in the French journals, I will translate and send it you.

A week or two ago, while making a journey to Havre, I found that in consequence of my availing myself of a seat in a private conveyance which started before the coach, and was going part of the way, that on arriving at Pont l'Eveque (a town midway between Lisieux and Honfleur) I had an hour to spare, the deligence being far behind. This leisure I occupied with a stroll up the principal street, giving the little French boys and girls an opportunity of staring at a foreigner, and myself the satisfaction of observing them. On crossing a little bridge thrown over a narrow branch of the main stream which runs through the town, my eye accidently rested on a flour-mill; but from the absence of the external features of such buildings, I was induced to examine it with some attention. The front was in the street, and the wheel was attached to the side wall nearest the water, consequently, having the whole of its parts exposed to view. This position of the water-wheel is very common in this part of France; but I never remember to have seen it in England, except in drawing master's copies of picturesque scenery, and in those touched up duplicates of the same with which wonderful sons astonish their mothers at vacation time. Leaning over the bridge, I was surprised to observe the longitudinal narrowness of the wheel, and the very inconsiderable slip of water that was necessary for its action. The length of the paddles could not, I think, have been more than eighteen inches; and though the wheel, from its great height, must have been very heavy, the little fall of water (about two feet in width) was sufficient to turn it in a very vigorous manner. Seeing the small space that was occupied, and the sufficiency of so trifling a fall, the question occurred to my mind,—why are not water-wheels fixed in the kitchens or sculleries of hotels, eating-houses, coffee-shops, and private establishments where there is a great deal to do? Might not a tank or cistern of rain water, aided by a pipe from the water-works, supply a stream, which flowing in a trough or channel, might fall on the paddles of a small wheel? The form of this trough or artificial channel, its relative position with the wheel, and the height of the fall, are a detail of easy arrangement which common workmen practically understand. To the shaft of this wheel, might not a sufficiency of appropriate gear be attached to carry on a variety of domestic operations, such as coffee-grinding, spit-turning, pumping, &c. &c.? And might not the water, after it has performed its functions, be pumped up again into the original tank or cistern of supply? In this age of the march of mind, it is highly desirable to have some cheap and simple machinery to discharge the coarser labours of servants, who, very properly, wish to avoid unnecessary domestic drugery. Though many look forward to the days when steam-engines will be applied to this purpose, there is, and will be, for some time, two obvious impediments to their domestic use; one is the expense; and the other is the danger from accident or carelessness. Both these objections have been greatly mitigated of late, and will, no doubt, greatly lessen in future; but, at present, it is, I think pretty obvious that water power, although less convenient and efficient than steam in large undertakings, is much more economical. One of the objections that might be raised against having a water-wheel in a house, is, the disagreeable noise. But this would be only a temporary matter, and might be mitigated by placing the wheel outside the house, and in a situation where it could be as little offensive as possible "to ears polite."

To throw down a vagne scientific idea on public ground requires a little courage in these days of criticism; but I feel neither afraid nor ashamed. In matters of practical science my opportunities have never corresponded with my taste and desires; and my pursuits have been of a different kind. It is possible, therefore, that my scheme may be impracticable in

consequence of my having overlooked many little impediments in detail with which practical men are alone familiar. Imperfect knowledge, when it is not accompanied with presumption, is neither criminal nor disgraceful; and I consider it not one of the least advantages of magazines like yours, that they indulgently afford to intelligent crudities, "a local habitation and a name." In this way mind is made to assist mind. The experience of one supplies the deficiencies and corrects the false data that are the consequence of the inexperience of another; and the stimulus of publication causes many young amateurs of science to follow up their ideas, and teach them "how to shoot," and to set aside many early errors which they would otherwise have continued to regard as truth and the *ne plus ultra* of the matter.

That the PENNY MECHANIC will be the friend of the *pennyless* mechanic, and the liberal advocate of science, is what I sincerely hope, and have reason to believe, from the evidence afforded by the Numbers that have been hitherto published.

Your obedient Servant,

E. A.

## MISCELLANIES.

*To make Ginger-Beer Powders.*—Take two drachms of fine loaf sugar, eight grains of ginger, and twenty-six grains of bicarbonate of potash, all in fine powder—mix them intimately in a Wedgewood's-ware mortar. Take also thirty grains of citric or tartaric acid, (the first is the pleasantest, but the last the cheapest.) The acid is to be kept separate from the mixture. The beer is prepared from the powders thus: take two tumbler glasses, each half filled with water—stir up the compound powder in one of them, and the acid powder in the other: then mix the two liquors—an effervescence takes place—the beer is prepared, and may be drunk off. The effervescence is occasioned by the discharge of the carbonic acid of the carbonate of potash. If the beer is allowed to stand for a few minutes, it becomes *flat:* this is owing to its having lost all its carbonic acid.—The cost of these powders is about sixpence a-dozen sets.

*The Weavers.*—The arts of spinning, throwing, and weaving silk were first introduced into England about the middle of the fifteenth century, and were then practised in London by a company of women, called, from the nature of their occupation, silk-women. About 480 men began to engage in the silk manufacture, and in the year 1686 nearly 50,000 manufacturers of various descriptions took refuge in England in consequence of the revocation of the edict of Nantes by Louis le Grand, who sent thousands of the most industrious of his subjects into this kingdom to present his bitterest enemies with the arts and manufactures of France, and hence the origin of the silk trade in Spitalfields.

## INSTITUTIONS.

*London Mechanics' Institution.*—As we are frequently receiving letters from Correspondents, requesting to know the terms of subscription, &c., to the different Literary and Scientific Institutions in the metropolis, we intend to give a short account of them in our succeeding numbers. By this means our readers will be able to make a choice if they wish to belong to any of them, and we shall afford the educationist a glimpse of the means now in use for the improvement of the people of the metropolis. We think we are acquainted with nearly all the Mechanics' and Literary Institutions of London; but we shall be happy to receive information from their Secretaries or members, in order to prevent the possibility of any misstatements. The first we shall notice is one that deserves this distinction, not only on account of its being the first established, but also because it is probably more interesting to our readers than any other. The London Mechanics' Institution, situate in Southampton-buildings, Chancery-lane, Holborn, was established on the 3rd December, 1823. Before this period the mechanics of London did not possess the advantages enjoyed by many of their Scottish brethren for obtaining scientific knowledge; and great honour is due to those excellent gentlemen who originally proposed and formed an Institution for improvement of *working men.* Every member, by paying *six shillings a quarter*, and two shillings and sixpence entrance fee, is entitled to the following advantages:—*Lectures* every Wednesday and Friday evenings, at half-past eight o'clock, on different branches of science and literature. A *Library* of excellent books. There are nearly 7,000 vols. for circulation and reference. There are also *Reading Rooms*, supplied with nearly all the morning and evening newspapers and magazines. *Classes* for the study of almost every branch of knowledge. Most of these classes are under the direction of

teachers, and a small additional subscription is required in order to belong to some of them. The affairs of the Institution are conducted by a President, four Vice Presidents, and 30 Committee men, who appoint a Secretary. Fifteen of the Committee go out of office by rotation every six months, and are not eligible to be elected until they have been out of office for a similar period. Two-thirds of them are obliged to be chosen from among the working clases. The average number of members is about 1,200.

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LECTURES DURING THE WEEK.

*London Mechanics' Institution*, Southampton-buildings, Chancery-lane.—Wednesday, July 5, Colonel Thompson, M. P., on the Currency.—Friday, 7, J. Pereira, esq., on the Senses, both at half-past eight.

*Western Literary and Scientific Institution*, 47, Leicester-square.—Thursday, July 6, Mr. Moore, on Poetry and the Living Poets, at half-past eight.

*Eastern Athenæum.*—Wednesday, July 5. No lecture.

*Poplar Institution*, East India Road.—Tuesday, July 4. No lecture.

*Gower Street.*—Tuesday, July 4, Mr. Angell, on the Steam Engine, at eight o'clock.

*Finsbury Mutual Instruction Society.*—Tuesday, July 4, the Author of "The Mechanics' Saturday Night," on the Love of Praise, at half-past eight.

## QUERIES.

*To the Editor of the Penny Mechanic.*

Sir,—I should be very much obliged if you or any of your correspondents would inform me of the best material to make a Fire-balloon for aeronautical purposes; and also the best method of making it air-tight and fire-proof: you will greatly oblige,

Your obedient Servant. H. F.

[The "Mongolfiers" described in Number 28, would probably suit "H. F." better than one of his own making. They are very cheap, and may be procured at Darton's, on Holborn Hill, and of other respectable Booksellers and Stationers.]

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Sir,—Knowing that your valuable paper is the vehicle for the disseminating and interchanging of knowledge, I take the liberty of putting two questions, to which some of your numerous readers will, no doubt, furnish answers.

The first, put to me by a friend, and which I was not able to reply to, is, "by what principle are the Steam Packets worked, which run between London and Westminster Bridges," the propelling force of which is (as I am informed) Mercury.

The second is to know the cause of, what appeared to me, a curious phenomena; namely, I being on the platform in the large room at the Crown and Anchor Tavern, on Monday, at the meeting of the Working Classes, was struck with the distinct echo, which at the commencement of the evening, followed the expressions of the speakers. But I was no less surprised, when at the conclusion of the business, or I should say towards the conclusion, the voices of the speakers were not resounded at all. I judged whether the air, by being impregnated with the carbon (which I have understood, human beings, as likewise other animals, give out) escaping from the auditory, became thereby a less conducting medium. If you, or some of your readers, will be so good as to reply to the above, you will oblige,

Sir, A Lover of Science.

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ANSWERS TO QUERIES.

*Permanent Ink for Marking Linen*—Dissolve a drachm of lunar caustic (fused nitrate of silver) in thrice its weight of distilled (or rain) water, and add about half a drachm of gum-arabic. This forms the ink, with which you must write or rather paint, with a clean pen upon the linen prepared as follows:—dissolve half an ounce of subcarbonate of soda in an ounce of distilled water, and add twenty grains of gum-arabic, this forms the mordant. Well moisten with the mordant the part of the linen that is to be written on, dry it by a gentle heat and then apply the ink in the manner above directed to the place that has been moistened The writing when exposed to the sun becomes black.

J. R. Watts.

*Living Models.*—There are occasionally a few artists who collect a certain sum for the purpose of studying the life, generally for a season only, when another assembly is formed. However, there is a sort of academy in Sutton-street, Soho Square, between the Catholic Chapel and Music shop (corner house), where persons are admitted on paying the requisite fee, and have an opportunity of studying from the living model.

P. H. D.

## TO CORRESPONDENTS.

*The Letter respecting the* Quarterly Meeting of the London Mechanics Institution, *shall be inserted.*

Z. Z.'s *communication is too personal and offensive to be published.*

Mr. Saul, of Lancaster, *shall receive a private communication.*

S. W. *We will give an engraving of a Steam Boiler in an early number; he will then perceive that some of his suggestions are acted upon at the present time, and perhaps be able to improve upon them.*

Saint Monday—School of Design—The Human Body, *and the insertion of one or two papers that are accepted from Correspondents, have been unavoidably postponed.*

*We have not overlooked the papers sent us on* Perpetual Motion, *but other more pressing subjects have hitherto prevented our publishing them.*

T. B—*We beg to inform this Correspondent, and several who have written at different times to know if we would introduce* Chemistry *into the Magazine that we now intend to do so. The first paper will probably appear in our next number.*

Mechanicus *declined, with thanks.*

Verulam Philosophical Society of London *shall appear next week.—We are much obliged to* Professor Dewhurst *for his kind offer, and shall feel happy in inserting any papers he may be pleased to favour us with.*

*Received* Operative Mechanic *and* Jack's Brother.

*Received* F. V. E.,—A Reader, *and several* Queries *and* Answers.

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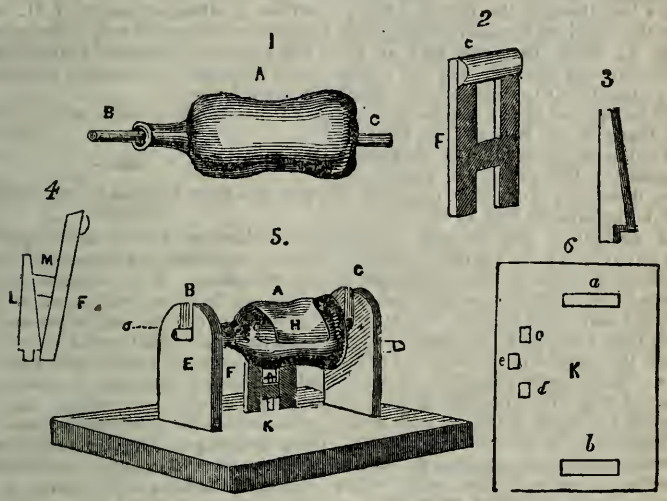
# THE PENNY MECHANIC.

A MAGAZINE OF THE ARTS AND SCIENCES.

No. XXXVII.] SATURDAY, JULY 8, 1837. Vol. I.

CHEAP ELECTRICAL MACHINE.




PERPETUAL MOTION.

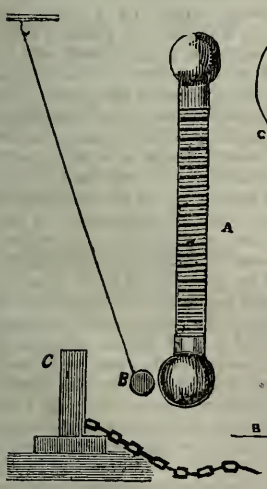
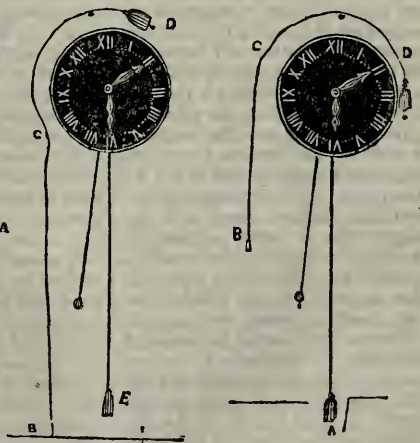



Fig 1. A SIMPLE ALARUM. Fig. 2.






Holloway Press: D. A. Doudney.

## CHEAP ELECTRICAL APPARATUS.

SIR,—Thinking the following description of a simple electrical machine would be acceptable to your readers, I take the liberty of requesting the insertion of it in your cheap and useful periodical, if you consider it worthy of that honour.

Fig. 5 shows the machine complete. The construction of it is as follows:—Make a hole through the bottom and opposite the mouth of a common wine bottle (A, fig. 1), about the same size as the mouth; through this hole and the mouth pass a spindle (B C),—the end B of which should be squared to fix a handle on—and fix it firmly in the bottle. The bottle is then fixed in the frame (fig. 5) in the following manner: the end of the spindle (C) passes through a hole (the diameter of which is the same as that of the spindle,) in the upright *c*, and the end B slides down the groove E (in the other upright), the bottom of which is the same height as the hole in the upright *c*, so as to keep the bottle in a horizontal position; the spindle is kept from starting up by passing a pin through the upright in the direction of the line *a*. Next make a cushion of wash-leather, stuffed with wool, and fasien it on the top of the frame E (fig. 2) with glue; this frame is to be of such a height that the cushion shall press against the side of the bottle; a piece of black silk (which for the sake of clearness is omitted in fig. 2, but is marked H in fig. 5,) is to be sewn on the top of the cushion, and is to hang over the bottle as represented in fig. 5. The method of keeping this cushion pressing against the bottle will be better understood by reference to fig. 6, which is a plan of the board K, in which the uprights are fixed. *a* and *b* are the places of the uprights; *c* and *d* are the holes in which the ends of the cushion frame are put; a long wedge (represented in fig. 3,) is put in the hole *e*; another wedge is then put between the cushion frame and upright wedge: this is better explained, perhaps, by fig. 4, where F is the cushion frame (or rather a section of it); L the upright wedge, and M the wedge which is put between the cushion frame and upright wedge. The cushion should be smeared with a mixture of quicksilver scraped from the back of a looking-glass, and tallow. Before the machine is used, the bottle had better be held before the fire for about half a minute to insure its not being damp.

The conductor may be made thus:—At right angles to one end of a cylinder of wood, about 2½ inches in diameter and 6 inches long, fix a smaller wooden cylinder, about ¾ of an inch in diameter, and 3 inches long, rounded at both ends; the other end of the larger cylinder is to be rounded. Cover the whole with tinfoil, and mount it on a stand with a glass rod. When used it is to be placed with the cross piece parallel to, and within about half an inch of the bottle, and should be of such a height as to come just below the silk apron. The leyden phial described by J. H. is to be placed at the round end of the conductor. If the cushion is pressed against the bottle with the hand, the machine will be found to work better.

I am, Sir, yours respectfully,
F. V. E.

## THE NEAREST APPROACH TO PERPETUAL MOTION.

THE following is the nearest approach to that "*opprobium philosophicæ*," the perpetual motion. It is not liable to the resistance offered by friction, or to the disparity between the motive power and the reciprocal force that would keep it in motion, which is an irremediable objection to all *mechanical* attempts to effect it. It consists simply of a glass tube filled with successive pairs of silver and copper leaf (Dutch gold leaf), separated by pieces of common writing paper, in alternate layers, until the tube is filled with the series. Thus constructed, it forms what is known to electricians by the name of "De Luc's Electrical Column," and if closed from atmospheric access by a brass knob at each end, is capable of yielding electricity of considerable tension, and will remain in action for years. The hygometric moisture contained in the paper producing sufficient oxidation of the copper leaf, and corroding it very slowly, so as to develope a continuous current of voltaic electricity, a pith ball (B) is suspended by a single fibre of spun silk, so as to vibrate readily between one of the brass knobs of the tube, and a piece of wood (C), covered with tin foil, placed on a table, or connected to the ground by a chain. Under this arrangement, the feeble current of electricity will first attract the pith ball, then having communicated to it an excess of electricity, it will become positive, and be immediately repelled, until it touches the tinfoil conductor, where it parts with its excess of electricity, and becomes negative, returning to its perpendicular position again, when it is again attracted and repelled as before; this repulsion is owing to the well-known law that bodies *similarly* electrified always repel each other, while those in an *opposite* state of excitement exert an at-

tractive influence. Thus the same effects being constantly produced, the vibration of the pith ball will continue as long as the electric current exists, which, if the outside of the tube be kept clean and dry, may be for an indefinite number of years.

BRACK HIMSELF!

### A SIMPLE ALARUM.

SIR,—In reading your valuable journal of the 10th of June, I observed a letter and drawing of an alarum by "Brack's Brother," but that being rather complicated, I propose one very simple and not expensive. Measure one of your clock lines with the weight attached, in order to know how much it runs down in an hour: say it does so five inches; if you want it to strike in two hours place at the distance of ten inches from the clock a flat piece of board, with a trap cut in it, so as to open downwards with a small pair of hinges. Fasten a hanging bell up high, with a string attached to it, so short as not to reach the trap. Tie a small wedge to the other end of the string, pull the string down to the trap, catch the wedge so as to hold up the trap, and when the clock weight descends to the trap it will go down, the wedge will fly up, and the bell will consequently ring. By inserting this in an early number, you will much oblige your constant reader and well-wisher,

EDMUND GREDLEY.

#### DESCRIPTION OF ENGRAVING.

Fig. 1 represents the alarum while set; A is the trap, B the wedge, C the rope, D the bell, E the clock weight. Fig. 2 represents it after it has gone off; A is trap open, B the wedge after it has flown up, C the rope, D the bell in its proper position, E the clock weight, which by descending has opened the trap door.

## SAINT MONDAY.

ALTHOUGH it is undoubtedly true, as most of our readers have probably experienced, that "there are few things to be seen in London without Money," still there *are* a few, and as they may not be known to the majority of our readers, we shall have much pleasure in giving the particulars of those we are acquainted with that tend to improve the mind and refine the taste; and we are happy to say that there are several free exhibitions of this description. We introduce the subject under the title "Saint Monday," because we address ourselves to the industrious classes, who have but few opportunities, except on these occasions, of visiting such places as those we shall describe. We know that "Saint Monday" has fallen somewhat into disrepute in consequence of the manner in which many persons abuse the holiday or half-holiday, that might be made not merely a harmless useful relaxation from the labours of the week, but also a time for intellectual improvement—for the cultivation of a taste for the fine arts—and for the gratification of a most laudable desire for knowledge. Although we should be sorry to see "Saint Monday" kept merely that the workman might have an opportunity of spending his week's earnings in the course of a few hours in the gratification of a disgraceful appetite for gin and beer, yet we are sure that the majority of our readers, and workmen generally, would employ a holiday in a manner so much more becoming rational creatures that we should indeed be sorry to see our artizans so much reduced by poverty or so degraded by the love of gain, that they could not spare a few hours now and then—in the afternoon of "Saint Monday," for instance, in order to cultivate their sympathies with the beautiful in nature and art. Although as Wordsworth says,—

> One impulse from a vernal wood
> May teach you more of man,
> Of moral evil and of good,
> Than all the sages can.

Yet most assuredly next to the impulses that we receive from viewing the works of nature, are those which even the most unlettered must derive from seeing such beautiful representations of nature as those, for instance, that are preserved in our National Gallery, and in the exhibitions that are opened from time to time in the Metropolis, to which the public are admitted on payment of a small fee. It is a disgrace to a country so rich in works of art as England, that the public should be excluded from seeing them unless the visitors are so fortunately situated that they can afford to pay "the fee upon fee" that is demanded for exhibiting. We sincerely trust that the meeting lately held at Freemasons' Hall for the purpose of petitioning against the continuance of these practices will be productive of good. In France, and other continental countries, a workman when he takes a holiday can gratify his taste for the beautiful in art, without depriving himself of some little comfort that he obtains out of his weekly earnings. With the English artizan, however, it is very different; he must either pay "like a gentleman," or deprive himself of the gratification he desires.

The impolicy of allowing this state of things to continue is becoming more evident every day. It not only deprives people of an intellectual enjoyment, and induces them to have recourse to pleasures of a less moral and often positively degrading character; but it also keeps the artistical taste of our manufacturers far behind that of continential workmen. In every point of view, therefore, it is impolitic not to afford our artizans the opportunity of visiting without impediment the collections of works of art in this country; and we look to aliberal and enlightened government for the removal of the causes that prevent this taking place, and for the realization of the hopes that have been so often disappointed by "Men having authority." As we have stated, however, there are many beautiful collections of paintings and other works of art, in and about the Metropolis, to which the public are admitted gratuitously on observing certain forms, or by paying a very trifling admission-fee. These we shall proceed to describe in our next and succeeding numbers; and hope to be able to point out to our readers a variety of interesting exhibitions, where they can profitably employ a few holiday-hours occasionally, cultivating their taste at the same time perhaps that they are improving themselves for their different professions.

## STEAM BOILER EXPLOSION AT HULL.

We have received the following letter, pointing out what might be considered a mistake iu No. 35, in describing the manner in which the explosion was produced. A slight typographical inaccuracy has made the passage rather ambiguous, but every person acquainted with the rudiments of Chemistry knows that a compound body can only be decomposed by some substance that has a greater affinity for one of the elements than they have for each other; this is the case with steam as with every thing else, and we are much obliged to our correspondent for his description of its decomposition, although, as will be seen by the evidence given in No. 36, scientific men appear to think that oxygen must be obtained from some other source than the atmosphere.

*To the Editor of the* Penny Mechanic.

Sir,—In the article Steam Boiler Explosion in No. 34, it is stated that the explosion took place, not from the expansion of the steam, but from the decomposition of gases generated by the decomposition of the steam by the red-hot boiler, and that the gasses are the same as those used in the oxy-hydrogen microscope, viz., oxygen and hydrogen, the constituents of water. Now this seemingly good explanation is decidedly wrong, as I think the following will show. The reason why the steam is decomposed by the hot iron boiler is on account of the great affinity of the iron for the oxygen of the steam, which it separates and enters into union with, producing "oxide of iron," leaving the hydrogen *alone* in the boiler in the gaseous form; and hydrogen without oxygen will *not* explode. And it is clear that no atmospheric air which would supply oxygen, could enter the boiler, for if the valve or any other communication between the boiler and atmosphere were open, the steam would escape by that, and would effectually prevent any inward current. But supposing a small portion of air *did* enter, it would only be in small quantities, which would explode and form water with a *much smaller* portion of hydrogen. It is clear therefore that it could not arise from the explosion of gas or gasses, and if effected by gas at all, it must have been by the expansion of the hydrogen.

Yours, &c.
C. D. Thomas.

## THE KENT ZOOLOGICAL INSTITUTION,

ROSHERVILLE, NORTHFLEET.

It affords us no small degree of pleasure to be instrumental in giving publicity to new inventions or improvements which may tend to benefit any part or portion of our fellow-men, but we never feel so much at home or in our element as when we attempt to write on the merits of any undertaking which has for its object the comfort, happiness, and prosperity of the community at large; and we only regret our incapacity to set forth in more deserving terms the praiseworthy exertions of those gentlemen who, having the good, the real good of their countrymen at heart, sacrifice their time, and embark their property, in enterprises of the most beneficial character. We live in one of the most important eras in the career of time: the next ten or twenty years are big with events—such as will create a complete revolution in the system of things. A few years since—'twas in our fathers' time—a man dared not undertake a journey of fifty or sixty miles without first making his will, and going round the circle of his friends to take not unlikely a "long and last farewell," such were the contingencies attending travelling in those days. How different

now, even by stage-coaches! but what will it be when our Birmingham, our Southampton, our Bristol, our Brighton, and their various branch rail-roads are completed! why, we had nearly said, in a few hours we shall see them all! The fact is certain, that, should we live to see these railways finished, whether we travel by way of Southampton or Dover, we shall take breakfast one morning at Liverpool, and the next, at the same hour, in Paris! We shall step into Williams's, in the Old Bailey, and take lunch at two, preparatory to dining with a friend in Brighton, a little before five.

And, through the kindness of some happy-thoughted gentlemen, who have formed themselves into a Company for laying out grounds and establishing a Zoological Institution, near Gravesend, we shall take an evening promenade in their Gardens, after 'Change and Bank business is done. We have before us a prospectus issued by this Company, to which we are happy to see affixed the names of many respectable, influential, persevering men—men who have proposed, and will, we doubt not, carry into execution, this most desirable scheme, provided they have the co-operation and assistance of the public. We shall be glad at some future time to give a sketch of the plans on which their grounds will be laid out—for the present, however, we content ourselves with an extract or two from the prospectus referred to.

"The design of the Institution will comprehend a Zoological Garden, Museum, and appropriate Room for Lectures in every department of Natural History.

"The site of Ground chosen possesses the requisite properties for the Garden, which will be laid out perfectly unique, and the Buildings to contain the entire Zoological Specimens will be so constructed as to be visited at all seasons of the year.

"Measures will be adopted by which the Menagery will be enriched with the most choice subjects, both foreign and indigenous, that can be procured, in which the Committee of Management, in their zealous endeavours to promote the interests of Zoological Science, confidently trust to have the most liberal assistance from the several Socities now established.

"It may therefore fairly be presumed, that this Society will arrive at the same degree of eminence and utility as similar Establishments have in other Counties."

## SCHOOL OF DESIGN.

*To the Editor of the* PENNY MECHANIC.

SIR,—In common with every other person who desires to see a knowledge of the Fine Arts diffused as widely as possible amongst artizans and workmen of every description to whom it may prove useful in their various professions, I was highly gratified when I first learnt that Government intended devoting a sum of money for the purpose of establishing a School of Design. The utility of such an Institution must be apparent to every one who is at all acquainted with the present state of our manufactures. Continental workmen are acknowledged to be superior to our own in the art of designing, and the cause is, that the former have far greater opportunities for studying beautiful compositions and improving their tastes than we have. With but two or three exceptions every place containing any beautiful specimen of art is closed from public view, unless the visitor can afford to put his hand pretty deeply into his pocket. Besides this, what means have we for giving our workmen an elementary knowledge of perspective, or the principles of design? With the exception of a few classes at some of the Mechanics' Institutions, I know of none. The establishment of a School, therefore, where these things should be taught to young men, and where they could be prepared to enter upon their profession in the possession of knowledge not merely calculated to advance their own interests, but generally to improve the manufactures of the country, was indeed an object much to be desired. To accomplish it not merely fifteen hundred pounds, but fifteen thousand would not have been too much, but with the former sum alone much good might have been accomplished with judicious management. If, however, the School of Design is really to be formed according to the prospectus that has lately been issued, is there the slightest prospect of its being successful? The subscription is to be four shillings per week! a larger sum than the greater number of those for whom the school is to be professedly established, can afford to expend upon wearing apparel! Why, a number of young men subscribing together could have attained efficient masters, and, in time, a good collection of specimens at a much cheaper rate. Four shillings *per month* (double the subscription to the London Mechanics' Institution, where there are good drawing and modelling classes) would have been more reasonable than the sum *per week*, and the subscription must be greatly reduced indeed before working men can avail themselves of the advantages of the School. But there is another no less objectional pro-

vision; the rooms are only to be opened from ten till four o'clock. Really this regulation is so utterly inconsistent with any thing we might anticipate, that we cannot help asking, Who is this School intended for? Not, certainly, for those for whose benefit it is said to be instituted. Who can attend during the day excepting young artists who intend to follow up the study professionally? It appears to me that the object of Parliament in granting the money has been entirely overlooked, and if the young artizans of the Metropolis wish to obtain any benefit, they should at once present a petition to the House of Commons upon the subject.

I am, Sir, Yours respectfully,
N. S. N.

[From the prospectus that has been issued, it appears that the School *is* intended for young artists only. A School for working men, at a reduced rate of subscription, will be opened shortly; this will be held in the evening. Ed. P. M.]

## LIST OF PATENTS.

### ENGLISH.—MACHINERY.

*Berry, Miles*, Chancery-lane, Middlesex, for an improvement in obtaining motive power for propelling or working machinery. For six months, from 6th June.

*Blake, James Partridge*, Little Queen-street, Middlesex, for improvements in preparing rice, paddy, oats, and such other grain. For six months, from 30th May.

*Bodmer, John George*, Bolton Le Moors, Lancaster, for improvements in machinery for spinning and doubling cotton, wool, flax, &c. For six months, from 12th June.

*Buckingham, James*, Great Randolph-street, Camden Town, Middlesex, for improved combinations of machinery, to be applied where tooth gear and other mechanism have hitherto been used. For six months, from 17th June.

*Cook William Fothergill*, Hastings, Sussex, and *Charles Wheatstone*, of Hanover Square, Middlesex, for improvements in giving signals and sounding alarums at distant places by means of electric currents transmitted through metallic circuits. For six months, from June.

*Dansill, Joseph Choild*, Limpley Stoke, Wilts, for improvements in stone machinery. For six months, from 6th June.

*Gerish, Francis William*, East-road, City-road, Middlesex, for apparatus for closing doors, shutters, &c. For six months, from 30th May.

*Millet, Richard Oke*, Peupalls, Hayle, Cornwall, for improvements in instruments for extracting teeth. For six months, from 1st June.

*Nash, Theophilus John*, John-street, Downshire-hill, Hampstead, and *John Ross*, of Wild-street, Lincoln's Inn Fields, Middlesex, for an improved method of making (in wood and metals) letters, figures, and other devices, which having a flat surface, present by the aid of colours the appearance of projection and doomed letters, &c. For two months, from 19th June.

*Nicholson, William*, Manchester, for improvements in spinning machinery. For six months, from 17th June.

*Roe, Richard*, Everton, near Bawtry, York, for an improved machinery for making bricks. For six months, from 17th June.

*Thomas, James Leonard Clement*, Covent-Garden, Middlesex, for improvements in steam engines, and steam generators to save fuel. For six months, from 17th June.

*Woolams, Joseph*, Wells, Somerset, for improved methods of obtaining power and motion from known sources. For six months, from 30th May.

*Woone, Godfrey*, Berkely-square, Middlesex, for an improved method of forming plates with raised surfaces for printing impressions on different substances. For six months, from 12th June.

*Yetts, William*, Yarmouth, for an improved mode of caulking ships. For two months, from 19th June.

### CHEMISTRY.

*Kirkman, John*, St. Pancras-road, Middlesex, for an improved mode of removing carbonaceous incrustation from the internal surfaces of retorts employed in generating gas. For six months, from 8th June.

*Swaine, Edward Schmidt*, of Leeds, for a method of producing and preserving artificial mineral waters, and for machinery to effect same. For seven years, from 9th October next.

## PATENTS FOR SCOTLAND.

### MACHINERY.

*Adams, William Bridges*, Porchester-terrace, Bayswater, for improvements in wheel carriages. 2nd June.

*Debac, Pierre Bartlemy Guinebert*, Brixton, Surrey, for improvements in railroads. 12th June.

*Guynemer, Charles*, Manchester-street, Manchester-square, for improvements in piano-fortes. 24th May.

*Livsey, Joel*, Bury, Lancaster, for improved machinery for spinning cotton, &c. 21st June.

CHEMISTRY.

*Crawford, William Henry*, for preventing oxydation of iron, copper, &c., by an improved coating. 22nd May.

*Gossage, William*, Stoke Prior, Worcester, for an improved apparatus for decomposing common salt, and condensing the product. 2nd June.

*Sheridan, John Joseph Charles*, for improvements in the processes of the saccharine, vinous, and acetous fermentations.

## MISCELLANIES.

*To Brew a Gallon of Ginger-Beer.*—Two pounds of the best refined lump sugar, a couple of fresh lemons finely sliced, two ounces of the best fresh powdered ginger, and a desert spoonful of cream of tartar, are to be put into a gallon of fine soft water. Let the whole simmer for an hour over a gentle fire, taking care not to let it boil. Pour off the clear liquor, let it stand till cool, add a table spoonfull of porter yeast, milk warm, let the whole repose twenty-four hours, scum off the top, strain the liquor through a flannel bag, and bottle it up. By varying the proportions of the ingredients, the beer can be made hotter, sweeter, or more acidulous, according to the brewer's taste.

*The Steam Plough.*—The machine and auxilaries remain stationary during the time occupied by the ploughs in taking one furrow; they are then severally put in motion, and made to advance in three parallel lines, in order to keep pace with the breadth of land turned over, and to pull the ploughs accurately straight. The machine is impelled by the engines, and each auxiliary by its attendant man, who also shifts his plank onward as occasion requires. The machine and its auxiliaries have thus to be moved over a space of eighteen inches only, whilst the ploughs have each travelled 220 yards, and turned over 220 square yards of land nine inches in depth; in other words, the machine and auxiliaries have only to be moved eleven yards, in the time that the ploughs have travelled five-and-a-half miles, and turned over a statute acre of land. The ploughs perform their work at the rate of two miles an hour, and are subject to very few stoppages; so that eight acres and three quarters nearly of bog would be ploughed up in a day's work of twelve hours; or, taking the average of daylight throughout the year, and making a liberal allowance for hinderances from weather and other causes, one machine would plough up 2,000 acres in a twelvemonth. The principal machine, together with a six ton load of fuel, weighs about thirty tons, its superficial bearing on the moss is 390 square feet, giving a pressure of 178lb. on each square foot. Taking the weight of a man at 168lb., and the area of his foot at thirty square inches, he would, in walking, press with a weight at the rate of 806lb. per square foot, so that the machine has a buoyant of about four and three-quarters times that of a man, and could therefore travel on much softer soil than red moss, which is considered very wet and spongy.—*Journal of Agriculture.*

*Friction in Tubes*—At a late meeting of the Institution of Civil Engineers, a paper by Mr. Horne, descriptive of a mode which has been adopted successfully for ventilating a mine by forcing in air, was read. The pipes were five inches in diameter, and extended a mile; and the ventilation produced was complete. A discussion then took place on the friction of air and gas passing through pipes of different lengths and diameters. It was stated that the loss on forcing gas through 1000 feet of pipe, amounted to 75 per cent.; that is, if 100 cubic feet of gas are delivered through an aperture under a given pressure, only 25 cubic feet will be delivered through a pipe 1000 feet long, under the same pressure.

## INSTITUTIONS.

*Verulam Philosophical Society of London.*—On Wednesday, the 14th of June, the members and their friends dined together at the Ship Tavern, Water Lane; in order to commemorate the Birthday of their Founder and President, Professor Dewhurst; Henry Braddon Esq, of Emmanuel College, Cambridge, presided; and Dr. Brown, F.R.S.E., occupied the Vice Chair, on which occasion a splendid medal, executed by Mr. Shaw, of Gough-Square was presented to Professor Dewhurst bearing beneath his Armorial Bearings the following inscription.

To Henry William Dewhurst, Esq, Fellow of many learned Societies in England, Ireland, and America, &c. Professor of Astronomy, Anatomy, &c. this medal

was presented to him as Founder, President, and Director, by the Patron, Vice President, Council and members of this society as a small token of their esteem and admiration of his private worth, his brilliant talents, and great exertions in the diffusion of Literary and Scientific Information among all classes of society.—Fourth Session 1836-37.

On the same evening the first Braddonian silver medal was presented by Mr. J. K. Hunt, for the best Essay on the formation of minerals, by the learned chairman, who announced the following subject for competition; the prize to be also a splendid Silver Medal—"Does Geology prove the Earth to have been originally of a fluid origin: if so, upon what evidance?" All Essays to be sent in on or before December 1, 1837, (post paid) to the President, Professor Dewhurst, Verulam Cottage, Pentonville.

Jos. Dran,
*June* 21, 1837. Hon. Secretary.
*Vineyard Walk, Clerkenwell.*

LECTURES DURING THE WEEK.

*London Mechanics' Institution*, Southampton-buildings, Chancery-lane.—Wednesday, July 12, Basil Montague, Esq., on the Patriot and the Demagogue.—Friday, 14, Professor Calvert, on Elocution and the art of Reading, at half-past eight.

*Eastern Athenæum.*—Wednesday, July 12, J. Dunn, Esq., on Meteorology, at eight o'clock.

*Poplar Institution*, East India Road.—Tuesday, July 11, Robert Bindley, Esq., on the Theory and Practice of Naval Architecture, being the second of a course of lectures on Naval Architecture and the causes of Shipwreck, at eight.

*Gower Street Institution*, Cafe Colloseum, New-road, Monday, July 11, Mr. J. J. Hawkins, on the art of Lecturing, at eight o'clock.

*Finsbury Mutual Instruction Society.*—Tuesday, July 12, Colonel Thompson, M. P. on Political Economy,—the Curreney, at half-past eight.

## QUERIES.

*To the Editor of the Penny Mechanic.*

*Kite Carriages.*—Sir,—Can you tell me what sort of wood and what sort of calico I should use for making a kite for a carriage, and the way of managing the reins.

[Our Correspondent will find full particulars in the little book published by the inventor, and which may be obtained of Mr. Doudney our printer. We cannot answer the query at length in the Magazine.—Ed. P. M.

*Gilding Picture Frames.*—Will you, or some of your correspondents, be kind enough to tell me how to regild picture frames; an early answer to this query will much oblige,

A well-wisher to your
Useful Magazine, G. S. H.

*Linseed Oil.*—Sir,—you will much oblige me if you, or any of your correspondents, could inform me how to purify linseed and other oils.

I remain your constant reader,
Amator Scientæ,

ANSWERS TO QUERIES.

*Coloured Fires.*—Sir,—I beg to inform "A. B. Y. L." that the best fires are made in the following manner:—

*Red Fire.*—Forty parts of dry nitrate of strontia, which is sold in crystals containing water which may be expelled by putting them on the hob of a moderate fire for half an hour, thirteen parts of flowers of sulphur, five of chlorate of potash, four of sulphuret of antimony, and a little powdered charcoal; the ingredients should be separately powdered and mixed afterwards.

*Blue Fire.*—Sixteen parts of saltpetre, four of sulphur, and one of orpiment, and a little powdered charcoal.

*Green Fire.*—Sixteen parts of meal powder, three of copper filings, and a little charcoal. If the above is of any service to "A. B. Y. Z." he is welcome, and the insertion will oblige

Your Friend. Zamiel.

*To make Fusible Alloy.*—Sir, permit me, through the medium of your Magazine, to answer "J. D.'s" queries in your last number, how to make Fusible Alloy. Heat in a crucible four ounces of bismuth, two ounces of tin, and two ounces of lead, then add one ounce of mercury; the compound becomes fluid at 170°.

P.S.—I believe the above Alloy melts at a less heat than Parke's.

*To make Blue Signal Lights.*—Six ounces of saltpetre, two ounces of sulphur, and one ounce of sulphuret of antimony. When a lighted match is applied to this mixture a brilliant deflagration takes place: it can be seen at the distance of fifty miles.

Yours respectfully,
E. Campbell.

## TO CORRESPONDENTS.

Mr. Cary, Shepton Mallet. *The drawing and description of a* new Coach Drag *shall appear in an early number.*

M. V. *The letter shall be translated and published.*

Frank. *Try æther. We have always found naptha do very well. In several of our back numbers there are communications on the subject to which he had better refer.*

Mr. Douglas. *The petition to the House of Commons respecting* Accidents in Mines *shall appear.*

*We shall have a word or two to say respecting the letter of* W. H.

M. N. *We shall be happy to receive the model, and when the description is published, will introduce the invention to the notice of some gentlemen who may probably be inclined to patronize it.*

*The letter on* Railway Tunnels *is too long; we will, however, endeavour to find room for it.*

Amator Scientæ *We do not remember the circumstance, but will refer to the subject, and if necessary, give a further explanation.*

*We have been obliged to postpone the letter from* Amicus *till next week.*

*Received several* Queries *and* Answers.

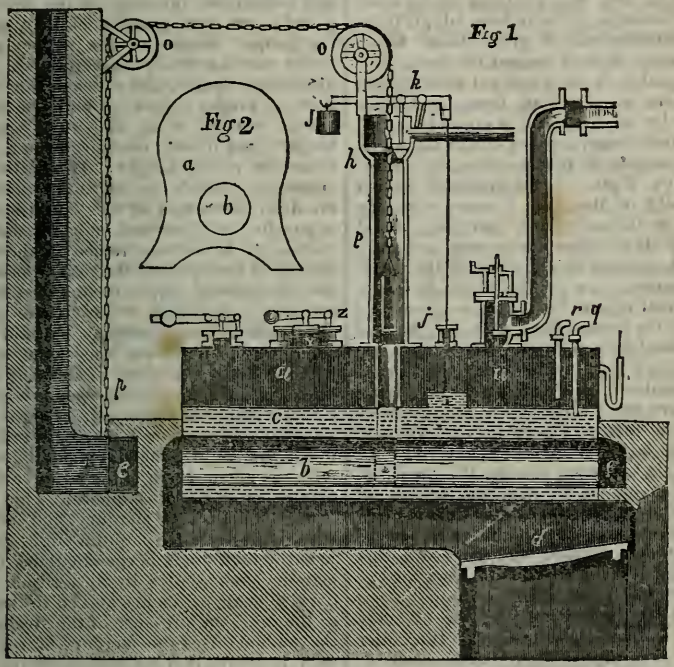
*The description of* Davenport's Electro-magnetic Engine *shall appear in an early number.*

London: Printed at the Holloway Press, by D. A. Doudney; published by Berger, Holywell-street, Strand; and may be had of all Booksellers.

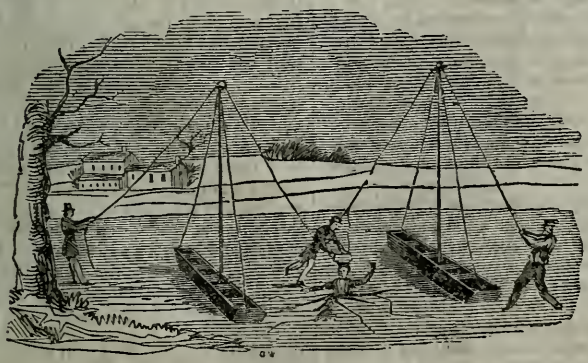
# THE PENNY MECHANIC,
## AND THE CHEMIST.

No. XXXVIII.] SATURDAY, JULY 15, 1837. Vol. I.

STEAM BOILERS.




APPARATUS FOR RESCUING DROWNING PERSONS FROM THE ICE.





Holloway Press: D. A. Doudney.

## STEAM BOILERS.

The earliest boilers employed for generating steam, and applied as a motive force, with which we are acquainted, were either globular or hemispherical, with flat or concave bottoms; and many of these are still in use for the supply of high-pressure engines. In situations where fuel is so abundant as to render needless any economy of it, they may continue to be used with advantage, as their form adapts them to withstand steam of great elastic force. The waste of fuel caused by them, elsewhere, led to a very general substitution of boilers of an oblong form; and those known by the term of "waggon boilers," from their shape, formed one of the many improvements of the steam-engine introduced by Watt. A longitudinal section of a boiler of this kind is represented by Fig. 1 in the subjoined engraving, fitted up with all the appendages now generally applied, and set in a furnace of the usual construction. *a a a* is the boiler, having a cylindrical return flue (*b*) throughout its length; the form of these parts will be best understood by considering them with reference to Fig. 2, which shows the figure of the boiler in its cross section (*b*), being the return flue; this portion of the boiler should be always placed near to the bottom, and be constantly kept covered with the water, as seen at *c* in the drawing. The flame and smoke from the furnace (*d*) first passes under the boiler, then returns through the flue (*b*) to the front, where the current is divided, and, passing to the right and left through lateral flues in the brickwork (one of which is brought into view at *e e*) before it enters the chimney (*ff*). The water is supplied to the boiler by the feed-pipe (*g*), which is made to contain a column of water equal to the amount of pressure in the boiler. On the top of this pipe is a cistern (*h*); *i* is a float, made of stone, suspended by a wire passing through a stuffing-box (*j*), which is attached to one extremity of a lever, whose fulcrum is at *k*, a weight (*l*) being suspended to the extremity of the other arm of the lever sufficient to counterbalance the difference between the specific gravity of the stone and the water, causing the former to lie on the surface of the latter. By this arrangement, when the water sinks below the proper level in the boiler, the stone float descends with it, causing the attached wire to operate upon the lever above, and lift the valve shown in the cistern (*h*), which then affords a fresh supply of water. The feed-pipe likewise contains an iron bucket, hung by a chain that passes over two pulleys (*o o*); the other end is attached to a plate of iron (*p*) called the damper, which is used to enlarge or contract, and, when required, entirely close the throat of the chimney. By this contrivance, when the steam in the boiler is urged to too great an extent, its pressure forces the water in the feed-pipe upwards, thereby raising the bucket (*m*), and causing its counterbalance, the damper, to descend in the throat of the chimney, and reduce the intensity of the fire. At *q* and *r* are two guage-cocks, by which the proper height of the water in the boiler may be always ascertained. If *q* discharges water, and *r* steam, the water is at the proper height; if both cocks discharge water, it is above its proper height; and if both discharge steam, it is below its proper height. This latter circumstance, which can only take place by the defective action of this last-described apparatus, is of serious moment, and requires an immediate remedy; the most safe is, in our opinion, the reduction of the fire, by stopping up, by the readiest means at hand, all access of air to the grate, after which, attention may be paid with confidence to removing the cause of the defect. For the purpose of showing at all times the pressure acting upon the boiler, a steam-guage is employed. This is usually made of an iron tube, bent into the form represented, one end communicating with the steam-room of the boiler, and the other open to the atmosphere. This tube is partly filled with mercury, and into the externally-open end is put a slight rod of wood, which floats perpendicularly in the mercury, and shows by its altitude, on a divided scale of inches affixed to that leg of the tube, the pressure of the steam. If the steam raises the mercury or rod one inch, it proves that the pressure is one half pound per square inch on the internal surface of the boiler, tending to burst it; for if the section of the bore of the pipe was just one inch, the pressure would be supporting one cubic inch of mercury, which will be found to weigh nearly half a pound; therefore, for every two inches rise, one pound pressure may be reckoned; and as condensing engines seldom work with more than three or four pounds pressure upon the inch, the scale need not be longer than eight or nine inches. For preventing the pressure becoming greater than the boiler is calculated to sustain without incurring danger, a safety-valve (*u*) is provided. This is usually a circular piece of metal, with a conical periphery ground to fit into a conical seat, and kept there by the pressure of a lever, loaded with a determinate weight, that will not suffer it to rise until the steam has acquired an excess of force above that required for work-

ing the engine, or would endanger the bursting of the boiler. In large boilers, especially those in steam-boats, it is usual to have another safety-valve, inclosed in a box under lock, the key being kept by the chief manager, to prevent the possibility of improper interference with it, by ignorant or imprudent persons: by the neglect of which precaution many serious accidents have occurred. The steam which escapes from safety-valves is generally conducted by a pipe from the valve boxes into the chimney. At *v v* is the steam-pipe by which the engine is supplied, the quantity being regulated by a throttle-valve at *w*, and a screw-down valve at *x*. For the purpose of cleaning out or examining the condition of the boiler, a circular or oval hole (*y*) is made sufficiently large to admit a man to pass through, and therefore called the man-hole. It is covered by a strong plate of iron bolted down, in which plate is usually fitted the atmospheric or vacuum safety-valve (*z*), which opens inwards by the pressure of the atmosphere, preventing the latter force from injuring the boiler, should a vacuum be formed by condensation within. A cock and pipe leading from the bottom of the boiler is employed for discharging it of its contents. The above description is taken from the Engineers' Encyclopœdia.

## APPARATUS FOR RESCUING DROWNING PERSONS FROM THE ICE.

*To the Editor of the* PENNY MECHANIC.

SIR,—In Number 36 of your Magazine, I perceive you have inserted a letter from a Correspondent who signs himself G. P. P. In this letter he notices my invention for saving drowning persons in the ice; but conceives the machinery to be imperfect, in consequence of its being only applicable to those who still retain sufficient strength to assist themselves, by placing the rope round their bodies. I think, Sir, my diagram given in page 27 is not properly understood, or perhaps my description was not so explicit as it ought to have been, otherwise G. P. P. would have seen I had provided for the assistance of those too far spent to help themselves.

The two flat-bottomed boats there given are placed on each side the water; with sufficient running tackle to allow a man to be drawn from either side of the river to the other. When a person has fallen in the ice, and is so far spent as not to be able to help himself, any one volunteering can be placed in the noose and carried off to the sufferer with the greatest ease and safety: he is then let down sufficiently low to seize hold of him, and placing a second noose round his body, they are both drawn up and borne off to the shore.

I have enclosed another diagram which, if you think worth inserting, you will oblige Your humble servant,

H. P.

## LONDON MECHANICS' INSTITUTION.

*To the Editor of the Penny Mechanic.*

SIR,—As a member of the London Mechanics' Institution, Southampton-buildings, Chancery-lane, I venture through the medium of your Magazine, to call the attention of the senior members of that Institution to the important motion that was adjourned from Wednesday the 7th June, (the quarterly meeting night), until the 26th of July inst.; the principle of which motion is, that all youths who shall hereafter join the Institution, being under 18 years of age, shall not be entitled to speak or vote at any of the meetings or elections in the Institution; and that no member shall be eligible to serve as a Committee-man until he has attained the age of 21 years.

I should not have taken this step but for the conduct of those few persons who, on the 7th inst. opposed the motion, and who perceiving that the great majority of the members then present were favourable to the proposed motion, conducted themselves in the most noisy, and unbecoming manner, and by continued motions for adjournment, succeeded at length in postponing the decision of the question, hoping thereby to obtain a majority against the motion at the adjourned meeting, it being well known that adjourned quarterly meetings are usually only attended by mere boys.

It is for the express purpose of frustrating such an improper attempt, that I now write thus earnestly to solicit the attendance of all those members who, from their mature age and experience, will be enabled to judge of the real merits of the question. Although I do not intend to enter into the subject to be discussed on the 26th instant, it appears to me to be so self-evident that it will be highly beneficial to the real interests of the members of the Institution that the adjourned motion should be carried; that I am anxious by every means in my power to ensure as full an attendance at the meeting as possible.

Entertaining this strong opinion, I beg to impress upon the minds of those persons who are really anxious for the

welfare of this Institution, the importance of attending the adjourned meeting on the 26th instant; and I wish also to impress them with the importance of attending (as much as possible) at all the quarterly general meetings of the Institution, the proceedings of which of late have been (owing to the absence of the majority of the senior members) far from satisfactory.

At the last three or four quarterly meetings there has been little else but a continued uproar; and through the agency of the juvenile members (led on as they are by a few persons whose simultaneous desire seems to he to create dissatisfaction and jealousy against the management of the Institution) measures have been passed which will, I fear, eventually prove very detrimental to the Institution. It is well known that out of about 1200 members, not more than 200 ever take any part in the elections for officers, or attend any of the meetings of the Institution, and of those a very considerable number are mere boys, who, from their extreme youth are wholly incapable of exercising a sound judgment on the different questions that come before them. Uniting, however, as they do with the persons I have before alluded to, they possess by their mere numerical force (and through the neglect of the members of more mature age) an influence in the elections and affairs of the Institution far beyond their real merit, and such an one, as if not checked, will ultimately throw the whole management into their hands.

It is the duty of *every* member of a public institution to lend the utmost aid in his power to maintain and preserve the true interests of any society to which he may belong; and not by his neglect allow its welfare to be trampled upon, its laws set at defiance, and the whole reduced to one chaos. Hoping this appeal will arouse the dormant energies of those to whom it is addressed,

I am, Sir,
Your Obedient Servant,
AMICUS.

[We have an objection to insert anonymous communications except on subjects of a perfectly neutral character; but the writer of the above having favoured us with his name, and stated why he does not wish it to be published; and as we know him to be a gentleman on whose statements we can depend, we do not object to the insertion of his letter. We must act differently, however, with another that we have received from an anonymous correspondent, charging certain members of the Institution by name with attempting tyrannically to deprive the younger members of their privileges. The least that the writer could have done was to authenticate such a letter by annexing his name. But even then we should have declined to insert the communication. We stated at the first that we should always endeavour to prevent our work becoming a cause of unnecessary vexation to any party, and we shall carefully avoid taking a part in the squabbles of any institution which can only interest a small portion of our readers, and had much better be kept from the public eye. —ED. P. M.]

## THE MARQUIS OF WORCESTER AND DE CAUS.

*To the Editor of the Penny Mechanic.*

SIR,—I don't know if you are acquainted with the following fact. Ninon de l'Enclos wrote to the Marquis d'Effiat, that visiting Bicètre with the Marquis of Worcester, they saw a man grappling the iron bars of his cell, and speaking with great vivacity. The warden told them that the name of the man was Solomon de Caus, who, in his madness, thought he could employ water exposed to a high temperature, instead of the power of men and horses; he wrote a book filled with absurdities, and sent it to the king; and that his madness being sufficiently proved, he was confined in the madhouse. The Marquis, continued Ninon, listened to this man during a long time, and came back all pensive, and was not satisfied till he had got the madman's book. Thus the English Marquis was wiser than my countrymen, and found in the book of Solomon de Caus the ideas he claimed as his own.

The book of Solomon de Caus was published in 1615, under the title of "Raison des forces mouvantes, arec diverses Machine tant utiles qú agréables."

If you wish to have a copy of the interesting letter of Ninon de l'Enclos, I will send it to you immediately, in French.

I remain, Sir, yours, &c.
M. J.—a Frenchman,
May, 1837. And Constant Reader.

TRANSLATION.

Letter from Ninon d'Enclos to Cingmars, to whom she was secretly married.

3rd Feb., 1641.

MY DEAR D'EFFIAT,—Whilst you are forgetting me at Narbonne, amidst the gaities of the court, and the pleasure of thwarting the Lord Cardinal, in compliance with the

wish you expressed, I have been doing the honours of Paris to your English nobleman, the Marquis of Worcester, and I take him, or rather he takes me, from one curiosity to another, choosing always the most serious, speaking little, listening with extreme attention, and fixing on those whom he interrogates two large blue eyes, which seem to pierce to the bottom of the soul. Moreover, he is never satisfied with the explanations that are given him, and hardly ever views things in the light in which they are placed before him. Witness the visit that we paid to Bicètre, where he pretends to have discovered in a lunatic a man of genius. Had he not been in a state of raving madness, I believe he would have requested his liberty, in order that he might take him to London, and listen to his follies from morning to night.

As we were crossing the lunatics'-court, and whilst—more dead than alive—I pressed close to my companion in alarm, a hideous face showed itself behind a large grating, and began crying out in a broken voice, "I am not mad—I have made a discovery that will enrich the country which puts it in execution." "And what was his discovery?" I inquired of the guide who was showing us the establishment. "Ah!" said he, shrugging his shoulders, "something that you would never guess; it is to make use of the vapour of boiling water." I began to laugh. "This man," continued the keeper, "is named Solomon de Caus; he came from Normandy, four years ago, to present to the king a memorial on the wonderful effects that his invention was capable of producing. He asserts that with steam we might turn mills, propel carriages, and I know not what besides, with a thousand similar wonders. The lord cardinal sent away this lunatic, without listening to him. Solomon de Caus, instead of being discouraged, assiduously renewed his applications, till his highness, wearied by his importunity, and vexed at his follies, ordered that he should be confined at Bicètre, where he has been for three years and a half; and, as you have yourself seen, he calls out to every stranger that he is not mad, and that he has made an admirable discovery. He has composed a work* on the subject, which I have here." The Marquis of Worcester, who had become quite thoughtful, asked to see the book, and, after having read a few pages, said, "This man is not mad, and in my country, instead of being put in prison, he would have made his fortune. Take me to him—I wish to question him." This request was complied with, but he returned sad and pensive. "Now he is indeed mad," said he; "misfortune and captivity have for ever deprived him of reason; you have made him mad: but when you threw him into this dungeon, you confined the greatest genius of your time." He then left the place, and ever since he has spoken of nothing but Solomon de Caus.—Adieu, &c.

* The work of Solomon de Caus is entitled, "The Theory of Moving Forces with divers Machines, equally useful and amusing," and was published in 1615.

## THE HUMAN BODY.

### DIGESTON—3rd ARTICLE.

The most important chemical change that is effected in the food, previous to its being assimilated to the structure of the body, takes place in the stomach. This organ is situated on the left side, a little below the apex of the heart; when distended it is capable of holding about three pints, and in appearence is something like a bladder but it has two openings, and is larger at one end than the other. It is plentifully supplied with blood vessels and nerves; and in consequence of the latter being sent from different parts of the body, the stomach sympathises with any injury these parts may sustain. The celebrated Hunter called it the centre of sympathy; and Aberneathy affirmed that a man could not cut his finger without disturbing to a certain extent the function of digestion! We are all aware that it does exercise a very considerable influence over the other organs of the body and the functions they perform. The man who indulges in the pleasures of the table too freely over night receives a due admonition the next morning from his aching head and parched throat, not to commit a similar folly again, and when the digestive organs are suffered to become permanently deranged; when confirmed indigestion ensues it occasions by far the greater portion of all the "ills that flesh is heir to." The inner lining or coat of the stomach is exquisitely sensible; this occasions its being frequently deranged. Infants very often die when from any circumstance they are deprived of their natural food, the milk, in consequence of the stomach refusing to digest aliment of a different description; and when poisons are introduced into the stomach vomiting is generally produced in consequence of the great sensibility of the structure of which we are speaking. The digestion of food is a chemical process. A certain fluid called the

gastric juice is secreted by the stomach, and this fluid possesses the singular property of being able to digest or soften and form into a semifluid mass every thing that is exposed to its action in the stomach. For a long time digestion was very imperfectly understood, or rather it was not understood at all. It was observed on killing animals, a certain time after they had taken food, that a very evident change had been effected in it, but how this was produced the Physiologists of the time were wholly unable to explain; some thought it was by the pressure of the muscles of the stomach; and although they are weak and small, compared with those of the limbs, yet one philosopher demonstrated, as he thought, on mathematical principles, that these little muscles could contract with a force quite equal to 15,000lbs, and as this force was sufficient to crush anything that could be introduced into the stomach, he attributed the digestion of the food to pressure alone. This opinion was however soon proved erroneous, because it was observed that the skins of fruit, husks, of corn, &c., passed through the stomach quite unchanged, and this too when food of other kinds was perfectly dissolved. If the process was effected by muscular action alone this of course would not have been the case—all substances would have been crushed or digested alike. Another class of Physiologists compared the process of digestion to that of putrefaction, but there is no resemblance between them, unless indeed they are both chemical changes. The food however does not putrify in the stomach; the gastric juice produces an opposite effect—it stops putrefaction. Meat in a state of decomposition when introduced into the stomach of a dog was found in a short time to have become quite fresh, and it is found that this effect is invarably produced in the food of birds and animals that feed on carrion. It would be tiresome to the reader to have a description of the many theories that have been proposed at different times to account for the remarkable process we are describing; we shall therefore at once proceed to state what is at present known on the subject, without troubling him with by-gone theories and exploded doctrines. Within a short time after the food enters the stomach it is subjected to the action of the gastric juice—the powerful solvent fluid that we have just spoken of—and from a number of experiments made on rabbits and other animals, the manner in which the food is acted upon appears to be as follows: the food is kept in contact with the sides of the stomach by means of the muscles belonging to it, and absorbs a certain quantity of the gastric juice; in about an hour the outer portion of the mass is observed to become gelatinous; it becomes gradually more liquid and ultimately accumulates at the end of the stomach opening into the intestines: the food in this state is called chyme "it is a pultaceous and almost fluid substance of a greyish colour and acid taste, reddening paper coloured with turnsole; it is commonly said to be perfectly homogeneous in its nature; and that whatever be the species of food, the resulting mass is uniformly the same; never exhibiting any of the sensible properties of the crude alimentary matter. But this statement is not corrrect; for we learn by actual experiment that chyme produced from vegetable differs in colour, in consistence, and in some other sensible properties from that procured from animal substance. From a variety of interesting experiments by Dr. Wilson Philip we learn also that the digestion of food always takes place from the circumference to the centre, and that on the outside, and touching the coats of the stomach, is always digested before that in the centre of the mass. Fresh food is never mixed with that which has been in the stomach some time, it always passes to the centre of the mass; for the food does not mix indiscriminately, as we might at first be led to suppose. It might be naturally imagined that a fluid capable of digesting such a variety of substances of those which we partake of must be of a very powerful description; that it might be some strong acid, for instance, or possess some other remarkable property: strange to say, however, this wonderful fluid that is capable of digesting every thing, is almost tasteless; it has been procured from living animals and from some recently killed, and in all cases it was found to possess no remarkable property by which we might be led to imagine that is was capable of performing such wonderful changes as those which we know are produced by it. To the taste it more resembles salivia than any thing else and it is in appearance very much like it, or gum water. We must however reserve a description of its more remarkable properties for another paper.

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*British Association for the Advancement of Science.*—The next meeting of this Association will be held at Liverpool. The proceedings will commence on Monday, September 11, and continue during the week.

# THE CHEMIST.

We intend for the future to devote a portion of the Penny Mechanic to the science of Chemistry. We should have done this long since, but considering that only a limited space could be spared for the subject, if we did justice to the contributions of our correspondents on mechanical science, we thought it would perhaps be better to publish a separate work devoted entirely to Chemistry. Upon consideration, however, we have reason to believe that it will be better to introduce the subject in the Penny Mechanic. It is one of such great extent, that many of our readers may probably be inclined to think we shall hardly be able to afford sufficient space to treat it properly; but the plan we propose to adopt will, we think, allow us to do so, without infringing much upon the usual contents of the work.

We shall endeavour to make "The Chemist" interesting to all our readers. There are many who, being entirely unacquainted with the science, will desire to have information given them on elementary principles: this we shall endeavour to give as concisely and clearly as possible. There are many of our readers, however, who would rather desire to know what discoveries are made from time to time; how the various processes in Chemistry may be most simply and economically performed; what fresh applications of the science to the arts are proposed; and, in short, to be informed generally of the progress of the science. These things we shall also endeavour to bring before our readers in a satisfactory manner; and we have no doubt the papers we shall give will prove equally interesting to those who have made some advances in the science, and desire to know rather what is doing, rather than what has been done, as they will to those who wish to commence the study, and are at present quite ignorant of its principles. Indeed, it will be evident that a Magazine must devote itself principally to the former class of persons, if it wishes to extend its sphere of usefulness as wide as possible. There are such a variety of elementary works now published, and at so cheap a rate, that every person may become the possessor of one or more; but the journals that record the progress of Chemical Science are few, and very dear. *There is indeed at present no cheap chemical publication*—not one that has for its object what we propose to accomplish. Yet who will deny that it is of the greatest importance that the working man should possess the means of obtaining a knowledge of what is going forward in the scientific world. New and more economical methods of performing different processes in the arts are frequently discovered, but their utility remains unknown to a great majority of those who might take advantage of the discoveries, in consequence of the scientific works in which they are made public, being very expensive, and consequently limited in circulation. We think there are very few of our readers who will object to our devoting a portion of the Magazine for the purpose of remedying this as much as possible. By publishing queries, and we hope good answers by correspondents; by making the Penny Mechanic a vehicle for communications of this nature, and by carefully collecting information likely to prove useful to our readers, relating to the progress of Chemical Science, we hope to supply a want that has long been felt, but which we are sure, by the assistance of our Correspondents, we shall be able to supply a certain extent, if not completely.

To such of our readers as are at present entirely unacquainted with Chemistry, we have a few words to offer. We shall not dwell on the pleasures that attend the study, because they can only be properly appreciated by those who endeavour to obtain them. And dissertations on the advantages to be derived from the study of any particular subject, unless addressed to those who have a pecuniary interest in the matter, are generally of very little use. But a knowledge of the principles of this science may be obtained with so little trouble; the experiments are so pleasing; and the knowledge so useful to every man, in every sphere of life, that we feel sure the study will be prosecuted with earnestness and with advantage. Dr. Henry has very truly remarked, that the possession of the general principles of Chemistry enables us to understand the mutual relation of a great variety of events, that form a part of the established course of nature. It unfolds the most sublime views of the beauty and harmony of the universe, and develops a plan of vast extent and of uninterrupted order, which could have been conceived only by perfect wisdom, and executed by unbounded power. By withdrawing the mind, also, from pursuits and amusements that excite the imagination, its investigation may tend, in common with the rest of the physical sciences, to the improvement of our intellectual and moral habits; to strengthen the faculty of patient and accurate thinking; and to substitute placid trains of feeling for those which are too apt to be awakened by the contending interests of men in society, or the imperfect government of our own passions.

*Greenwich Railway.*—It appears from a statement that has been issued by the directors, that to complete the whole line to Greenwich it will require 80,000*l.*; that a dividend will shortly be declared out of the net profits of the Company, which, by the end of this month, it is expected will amount to 25,000*l.*; and after deducting for expenses 10,000*l.* for the half year, will pay a dividend on the old shares of upwards of five per cent. per annum.

## INSTITUTIONS.

### LECTURES DURING THE WEEK.

*London Mechanics' Institution*, Southampton-buildings, Chancery-lane.—Wednesday, July 19, Basil Montague, Esq., on Government.—Friday, 21, Professor Calvert, on Elocution and the art of Reading, at half-past eight.

*Eastern Athenæum*, Stepney-green.—Wednesday, July 19, no lecture.

*Poplar Institution*, East India Road.—Tuesday, July 18, Robert Bindley, Esq., on Naval Architecture, and the cause of Shipwreck, at eight.

*Gower Street Institution*, Cafe Colloseum, New-road, Monday, July 18, Mr. Dalton, on Animal Physiology, at eight o'clock.

*Finsbury Mutual Instruction Society.*—Tuesday, July 18, Mr. Collis, on the Atmosphere, at half-past eight.

*Bermondsey Mutual Instruction Society*, British School-room, Great George-street.—Wednesday, July 19, Mr. Newton, on Poetry, at a quarter past eight o'clock.

*Milton Street Institution.*—Monday, June 18, Professor Dewhurst, on the Physiology of Drunkenness, detailing the evils produced by ardent spirits and fermented liquors, upon the human constitution.

## QUERIES.

*To the Editor of the Penny Mechanic.*

Sir,—Will you allow one who has very lately commenced reading your useful little periodical, to enquire of some of your practically scientific readers, the way to make a solution of india rubber, and of applying the same to waterproof cotton and linen articles. I know that naptha is the usual menstruum; but some that I have had immersed for a fortnight exhibits no sign of dissolving. Perhaps you can, with less trouble, give me this information yourself. At your earliest convenience you will perhaps oblige me, as the occasion for which I require this information is very urgent.

I am, Sir, yours very respectfully,

FRANK.

### ANSWERS TO QUERIES.

*Lightning Conductors.*—Sir,—in number 32 of your valuable work, your correspondent J. R. Watts, M. D., in answer to your correspondent N. O'Mel, proposes glass rods with metallic points, having a communication by chains to one of Dr. Franklin's metallic rods; he also says, care should be taken that the chains do not touch the building. Now there is no occasion for glass rods, neither is there any danger in having a communication, or rather having the chains touch the building, for electricity will not leave a prime conductor and enter a bad conductor, therefore there is no danger upon that head.

If you attach a chain to an electrical machine, you will perceive the electricity pass along it; if you then place a wire by the side, the wire being the nearest way, the electricity will pass along it; then if you take away the wire and place a cane or stick to it, or twist the chain round it, you will see the electricity pass down the chain, therefore electricity will sooner go a very long distance with a good conductor than enter a bad one, however short the distance. The plan I suggest, is, to have an upright metallic rod come up the side of the building, entering the ground either into a cespool or well, and to branch out into very fine points some distance apart several feet above the building. From all I can learn as to the utility of metallic rods, they appear in a great number of cases to have failed, therefore a building is perhaps safer without them, for they tend to draw the electricity. A principal feature in building houses is to avoid all metallic substances towards the top, but unfortunately it is unavoidable.

Yours truly,

Z. WIGO.

P.S.—I take this opportunity of expressing my thanks to you for the enlargement of your magazine, which I hope will meet with that approbation from the public in general, and get that circulation which it deserves.

*Quill Making.*—Sir,—the process of dutching or removing the film from a quill is effected by a person seated on a stool within reach of a clear fire, into which quickly thrusting and withdrawing the quill, he immediately brings it between an obtuse scraper, working by a joint, and a stump, both affixed to a stool or table, and pressing down the scraper with the left hand, the workman draws forth the quill. This is the method I have seen practised; but would not the immersion in boiling water be preferable to fire?

Yours respectfully,

W. L. CLEMENTS.

*Parkes' Fusible Alloy.*—Bismuth eight parts, lead five parts, and tin three parts, melted together in an iron ladle.

*Blue Lights.*—Saltpetre sixty parts, sulphur forty parts, and meal powder twenty parts. The ingredients should be made very fine, intimately mixed, and sifted. If made well, these blue lights will burn under water.

F. V. E.

## TO CORRESPONDENTS.

*We shall be glad to receive another drawing and description of* Mr. Porlington's *improved Window Sash; it appears to deserve attention.*

J. R. Watts. *We shall make use of some of the papers enclosed.*

Philo *shall appear.*

No Party Concerned. *We will endeavour to find room for the Letter in an early number.*

J. F. S.'s *Letter contains some remarks that deserve consideration, and shall, most probably, be published.*

Frank, *we think will find the information he requires in Number* 16.

J. H. B. *The first volume will be completed in October.*

C. H S.'s *Paper shall be inserted.*

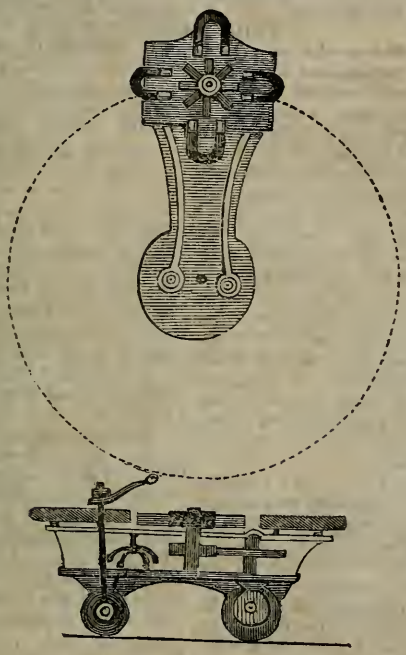
*Received* Z. F. P.—D. G.—T. M.—* * *, *and* Firebrand.

London: Printed at the Holloway Press, by D. A. DOUDNEY; published by BERGER, Holywell-street, Strand; and may be had of all Booksellers.

# THE PENNY MECHANIC,
## AND THE CHEMIST.

No. XXXIX.] SATURDAY, JULY 22, 1837. Vol. I.

DAVENPORT'S ELECTRO-MAGNETIC ENGINE.



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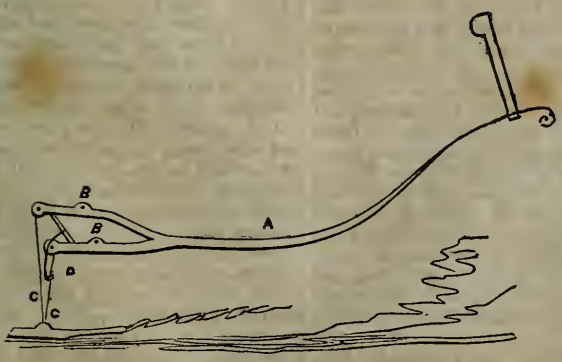


 Holloway Press: D. A. Doudney.

## DAVENPORT'S ELECTRO-MAGNETIC ENGINE.

*To the Editor of the* PENNY MECHANIC.

SIR,—In your 33rd number is a notice, taken from a New York paper, of Mr. Davenport's Electro-magnetic Engine, and you solicit further information on the subject. If the following crude account, the best I can give of it, is thought worth publishing, it is at your service.

PHILO.

I have seen Mr. D.'s model of a locomotive engine in action, and have conversed with him on the subject. He is a very modest unassuming man, and I heartily wish him success with his invention, which has been spoken of very highly by several scientific characters, who are expected to say something on almost all new schemes in which new branches of sciences are brought into operation; and perhaps, in the absence of positive indications of failure, it may be well for them to speak encouragingly, in order to create that interest in the subject which is necessary to enable the inventor to test the thing upon a large scale, as nothing short of this can be satisfactory. The anticipations of practical men, so far as I am informed, are not very sanguine, as to any favourable results from this invention, but they may be mistaken.

The model which I saw was a carriage 12 or 15 inches in length, with two wheels behind and one in front, and would pass swiftly round a circle of about two feet in diameter. It was made altogether of metal and very heavy; perhaps it weighed thirty pounds. I remember lifting it with my hands, and was surprised at its weight, but a larger one need not be proportionately heavy. The mechanism of this carriage consisted of four galvanic horse-shoe magnets, so placed that their eight ends formed a circle round a permanently-magnetic wheel, composed of eight arms, four of which being north, and four south poles, alternating with each other. The horse-shoe magnets are made of soft iron, with a hundred feet or more of copper bell-wire, covered with silk thread, and wound round them. The ends of these wires are connected with a galvanic apparatus, one wire is attached to the copper, and the other to the zinc, and in this way magnetic influence is given to the soft iron, which influence is reversed by reversing the wires, or changing the connections from the copper to the zinc, and *vice versa*, in rapid succession; and in this way a continual revolution of the wheel is kept up.

I have sketched two diagrams, which may assist the reader in understanding the mode of operation. In Fig. 1 the position of the magnetic wheel and horse-shoe magnets are shown, as well as the situation of the galvanic apparatus, near the centre of the circle. In the model which I saw a plate of metal extended from the carriage to the centre of the circle traversed by the engine, which served to guide the carriage, and support the galvanic apparatus, consisting of two separate cylinders of the capacity of not more than a pint each, and fitted up with concentric rings of copper and zinc. Two wires proceed from each of these vessels to the carriage; and here I am at a loss in giving the details of the manner of making the connections; but the reversing apparatus is very simple, consisting of two copper levers, each having four points very similar to spiders' legs. If the reader will suppose a four-legged animal suspended by its back to the upper plate of the engine, and alternately dipping its fore and hind feet into separate cups of mercury on the lower plate, he will have a pretty good idea of the action of these levers; one of which is sketched between the upper and lower plates of the engine in Fig. 2.

The connections between the magnetic wheel, and the wheels which run on the table or floor, can be traced in Fig. 2, and consists of two spur and two level gears.

If the mode of reversing the poles of the horse-shoe magnets were made clear—and I suppose some of your readers can supply this deficiency—the motions of the engine itself would be easy to comprehend; for, if we suppose the four wires of the alternate ends of these magnets to be brought in contact, they might all be operated upon simultaneously; and, if the arms of the wheel were placed between the ends of the magnets, as represented in Fig. 1, these arms would be repelled in one or other direction, and atrracted in the contrary one, until they came opposite the ends of the magnets, when the poles must be reversed in order to continue the rotation of the wheel; and this changing of the poles must take place as often as an arm comes opposite the end of a magnet, which in this case is eight times during each revolation of the wheel. But in some accounts which I have seen, it ts stated that these poles are changed more than a thousand times in a minute.

The changing levers vibrate slowly at first, and increase in proportion to the speed of the engine. Their action is not governed by any mechanical contrivance, but they seem to be impelled by the gal-

vanic fluid as soon as the connections are made by the wires, and the machine stops when this connection is broken.

## COACH DRAG.

*To the Editor of the Penny Mechanic.*

SIR,—I send you a drawing of a Coach-drag to enable the driver to drag and un-drag instantaneously, without stopping the horses, a model of which I exhibited at the annual meeting in 1835 of the Bath and West of England Agricultural Society, at whose rooms it may still be seen. If you think it worth a place in your Magazine, I shall feel obliged.

I am, Sir, your obedient Servant,
JOSEPH CARY.

Shepton Mallet.

A lever (A) is fixed by means of a joint (B B) under the hind axle; the drag-shoe is attached to the end of the lever by means of two uprights (C C), working in a separate joint in the forked end of the lever, but at the bottom they are forged into one, and are fixed to the shoe by a single joint. The reason for dividing the end of the lever into a fork, and using a double upright, is to give it sufficient strength to resist a strain sideways; it is necessary to keep back the upright in its place by a spring (D), otherwise the weight of the drag chain would pull it too forward.

To apply the drag the driver must lift the point of the guide (E), which is fixed to the side of the driving-seat, and place it over the hook on the top; this will press the shoe on the ground, and lift the wheel off,

I saw an account, about six months since, of a drag (invented by a gentleman of Oxford, if I mistake not,) and another in the newspapers lately, both of which act by friction on the wheel. I understand that friction-drags (many modifications of which have been tried), however effectual for a time, so heat and shake the wheel, that it soon destroys it; mine certainly will not do that, as it acts independent of the wheel altogether.

[We beg to recommend the above invention to the notice of the proprietors of the Paddington omnibuses that pass through Holborn and Oxford-street. The inconvenience of having to stop before proceeding up and down Holborn-hill and Snow-hill, might, we think, easily be remedied by adopting Mr. Cary's invention. The long stages that travel through hilly parts of the country would also find a drag of the kind above described of the greatest service; the expense of it would not be great; it might be made an ornament to a coach rather than an incumbrance. Those who have travelled on hilly roads know the inconvenience of being stopped every three or four miles, or two or three times in the course of a mile, in order to "lock the wheel;" the coachmen, however, feel it most, and we have no doubt would be happy to be relieved of the trouble of "pulling up" oftener than is necessary.]

## IMMATERIAL CAPITAL.

NO. I.

A FEW years since a prize was offered by an eminent philanthropist for the best essay upon the "Claims of Invention, &c." to be competed for by members of the London Mechanics' Institution, which was awarded at the anniversary meeting of the Institution to a talented but eccentric individual, whose name, however, I do not at present remember. I distinctly recollect that upon that occasion the president, Dr. Birkbeck, made extensive comments upon a term used by the essayist, which he had evidently coined himself, viz. "immaterial capital." The term was said to have been made use of as intending to designate that portion of the property of man which was not "current money with the merchants." In fact, the qualities of the mind, the mental talents which a man possesses, constitute his "immaterial capital."

The value of this kind of capital is very much misunderstood even in the present enlightened age; it is in general treated with a contempt which shows that the quintessence of ignorance has not even in the nineteenth century drained off into the channel of by-gone years, and is not spoken of by the world as "a tale that is told." It may always be esteemed as a proof and a manifest symptom of the barbarism of an age, when the esteem that a man meets with is regulated according to the quality of the coat on his back, and not according to the measure of talents he possesses. Let this test of civilization be applied to Britain, and we shall find that she is in this respect even behind the Esquimaux or the North American Indian. These savage children of nature are utilarians with a vengeance. A man is not esteemed among them for his stores of "barbaric gold and pearls," but for the qualities of his immaterial part, the talent he possesses, the *ingenuity* he displays in increasing the comforts of life, and in providing for his wants. Junius Redivivus has shown the method of *latent* protection, which they adopt in preference to what

may still be termed the humbug of *patent* law; and, though their rude ideas and manners are not worthy of imitation, their shrewdness and common sense are no debasing patterns for the minions of civilization to adopt. An improved method of taking fish or birds, or beasts of the forests, is held as truly valuable amongst them, and the inventor will avail himself of the protection which secresy affords; whilst that secresy is held inviolable, and even after, he is esteemed as a superior by those who are not so successful in their ideas; and so in England and other civilized countries, he may be esteemed as soon as he has branded his invention with a patent, but till then, till the gold has been brought forth, he is held to be a madman, a rogue, or a fool! There are, moreover, a certain class of individuals who have not a second idea of their own, and who want little more than a legal process to render them the inmates of a lunatic asylum: who, from the possession of a store of hard cash, which has descended from father to son, till it has come into their precious hands, invariably reap nearly all the advantages of the inventive genius of the country, by taking a mean and shameful advantage of the poverty of the class of inventors; and not content with the profits, they frequently pilfer the honest fame likewise.

To say that this resulted from the want of education would be an unpardonable truism, and we would not insult the common sense of our readers by such an assertion; but we would impress on them the necessity of an increase of their exertions to remedy the evil, by supplying this awful destitution. The real value of immaterial capital is always one and the same, and not arbitrary and fluctuating: it is moreover a capital which is far more indestructible than the gold which perisheth, and it is the brightest and the best endowment of a kind and gracious Providence: it is the natural inheritance of man, and not the acquisition of avarice, injustice, and fraud.

BASILIUS.

## MECHANICS' INSTITUTIONS.

*To the Editor of the* PENNY MECHANIC.

SIR,—I have frequently seen the numbers of the PENNY MECHANIC, among other periodicals for sale in various parts of the metropolis, but did not examine them, and from the appearance of the plates I had concluded that the articles were merely extracts, and intended for those persons who had but few books, and very limited knowledge of mechanical and scientific subjects. This impression has been recently removed, however, during an excursion through the north-eastern portion of the country. While travelling between Norwich and Yarmouth by a small steam-boat, in the cabin of which I had an opportunity of perusing most of the back numbers, furnished for the amusement of the passengers, and was much pleased to see the evidence of so much talent and good taste displayed in the work.

The attention paid to young inquirers, and to societies for popular improvement, struck me very favourably, as these are subjects congenial to my feelings, and to which my best efforts have been directed for many years.

I have been thus induced to make choice of the PENNY MECHANIC, by your permission, to lay before the operatives of London the following remarks for their consideration.

Among the various Mechanics' Institutions, it is a source of regret that so small a proportion of the members are belonging to the class of operatives; and, notwithstanding this is a subject of frequent complaint with many persons, yet nobody attempts to remedy the evil. In the smaller towns, societies must necessarily partake of a general and miscellaneous character, but in London, one would suppose, there might be a thousand mechanics found who would embrace the opportunity of uniting themselves to a society for improvement, provided they were assured the sole management would be in their own hands, and that the expenses would be within their means.

I need not dwell upon the fact, that the anticipations of the early promoters of Mechanics' Institutions are far from being realized, so far as the operatives are concerned. If any are disposed to doubt this, let them make the inquiry, and they will find it necessary, in some districts even in London, to visit many shops before they find an individual who is, or ever was, a member of a Mechanics' Institution, or any other society. I have been surprised to find so few who know anything about these Institutions, and yet it only requires a knowledge of the benefits to be derived from them, in order to their appreciation.

I would ask, is there not experience enough at the present day to form a Society of Mechanics for mutual improvement in the arts and sciences, upon an extensive scale and a sure basis? I think there is: and if these remarks should meet with the

responses of other persons devoted to the subject, who are willing to give it a fair trial, they may depend upon the co-operation of an

OPERATIVE MECHANIC.

*London, June* 24, 1837.

[We beg to call the attention of our readers to the above letter. The writer is known to us as one who will not flag in his exertions to render any plan successful that he may propose, or adopt from the suggestion of others. We shall be happy to do any thing in our power towards improving the mental and social condition of the industrious classes; and next week we will call their attention to a plan, which, if acted upon with spirit, may do much towards accomplishing this desirable object.—ED. P. M.]

## THE FINE ARTS

ALLAN Cunningham, in his "lives of the most eminent British painters, sculptors, and architects,"—a work that we cordially recommend to the notice of those who wish to learn something of the history of the progress of art in this country—gives a very happy description of the intimate connection that exists between the fine arts—showing their relation to each other, and the peculiarities by which each are distinguished. Poetry, Painting, Sculpture, and Music are the natural offspring of the heart of man. They are found among barbarous nations; they flourish among the most civilized; and springing from nature, and not from necessity or accident, they can never be wholly lost in the most disastrous changes. It may indeed be said that the tongue of poetry is occasionally silent, and the hand of painting sometimes stayed; but this seems not to effect the everliving principle, which may be justly claimed as their characteristic; they are heard and seen again in their seasons, as the birds and flowers are at the coming of spring; and assert their title to such immortality as the things of earth may claim. It is true that the poetry of barbarous nations is rude, and their attempts at painting uncouth; yet even in these we may recognize the foreshadowings of future excellence, and something of the peculiar character, which, in happier days, the geniuses of the same tribe is to stamp upon worthier productions. The future Scott, Lawrence, or Chantrey, may be indicated afar off in the barbarous ballads, drawings or carvings of an early nation. Coarse nature and crude simplicity are the commencement, as elevated nature and elegant simplicity are the consummation of art. When the Spaniard invaded the palaces of Chili and Peru, they found them filled with works of art. Cooke found considerable beauty of drawing and skill of workmanship in the ornamented weapons and war canoes of the islanders of the South Sea; and in the interior recesses of India sculptures and paintings, of no common merit, are found in every village. In like manner, when Cæsar landed among the barbarians of Britain, he found them acquainted with arts and arms; and his savage successors, the Saxons, added to unextinguishable ferocity a love of splendour and a rude sense of beauty, still visible in the churches that they built, and the monuments which they erected to their princes and leaders. All those works are of that kind called ornamental: the graces of true art, the truth of action, and the dignity of sentiment are wanting, and they seem to have been produced by a sort of mechanical process, similar to that which creates figures in arras. Art is indeed of slow and gradual growth; like the oak, it is long of growing to maturity and strength. Much knowledge of colour, much skill of hand, much experience in human character, and a deep sense of light and shade, have to be acquired, to enable the pencil to to embody the conceptions of genius. The artist has to seek for all this in the accumulated mass of professional knowledge which *time* has gathered for his instruction, and with his best wisdom, and his happiest fortune, he can only add a little more information to the common stock, for the benefit of his successors. In no country has painting risen suddenly into eminence. While poetry takes wing at once, free and unincumbered, her sister is retarded in her ascent by the very mechanism to which she must at last owe half her glory. In Britain, painting was centuries in throwing off the fetters of mere mechanical skill, and in rising into the region of genuis. The original spirit of England had appeared in many a noble poem, while the two sister arts were still servilely employed in preserving incredible legends, in taking the likeness of the last saint whom credulity had added to the calender, and in confounding the acts of the Apostles in the darkness of allegory.

## LONDON AND BIRMINGHAM RAILWAY.

*To the Editor of the Penny Mechanic.*

SIR,—Whether your anonymous Correspondent be related to "Jack," who does

so much execution upon some occasions, or justice, I do not know; but I say it is not always justice to act like "Jack's Brother." The tunnel under the Harrow-road, to which he alludes, certainly affords some reason for censure in its erection, particularly as the circumstance which you bring forward as an excuse does not bear upon the case. Nearly, if not the whole, of the tunnel was wrought by open cutting; consequently the difficulty of undercutting was avoided. The principal plea in excuse (if any ought to be allowed) is that the whole of the tunnel alluded to is out of the straight line, and therefore the centreing (I suppose in consequence of not making sufficient allowance in the framework of the arch) was continually being altered to allow for the curve or bend of the line. As to *danger*, it would be absurd to apprehend any: and if your Correspondent had ever been under the tunnel of the Regent's Canal he would most probably think so. In the latter case large portions of the brickwork protrude and yet no mischief has resulted, or is any likely to occur. As to humidity, the whole of that tunnel, to the present hour, is affected by it to a much greater extent. It should be considered also that at the time the earth was thrown upon the work of the Harrow-road tunnel (it being mostly in the winter) the rain and snow saturated it so completely that it was impossible but it would show itself: your Correspondent and his friends will find, when the earth, in a few months, has settled upon the arch, that this will form no ground of objection. The protrusion of the mortar I take to have arisen from another cause, and which, in public works, ought to be made a consideration. The materials in this instance were the best, but the lime not being allowed sufficient time to temper, in consequence of the humidity and the pressure united, and the work being very much hurried, caused the crush to take place before sufficiently set. This, however, may be remarked, that should such another tunnel be formed, it would, under such circumstances, be better to put the first layer of bricks upon the arch in cement, and the rest in mortar, which would, under the most humid circumstances, always secure to the work a more sightly appearance. The Primrose-hill tunnel is arched in with cement, and bears me out in the suggestion; and few persons will be found to object to its construction. As to stuccoing the tunnel, it could afford no security, and would be a needless outlay of capital.

I am, Sir, yours respectfully,

No Party concerned.

[We have received a second letter from the Correspondent who first wrote to us on the subject, in which he says, "the stability of the tunnel is quite unquestionable, nor did I say any thing to the contrary. I stated that it appeared to be carelessly built, and that there was an appearance of danger, which, considering the prejudice that exists against travelling in tunnels, the Company, in justice to themselves, ought to have prevented."—Ed. P. M.]

*Aldersgate-street Institution.*—Although this Institution does not offer quite so many advantages to the members as the Mechanics' Institute noticed in our last Number, yet it is equally, indeed more successful, as the building debt has been paid off, which is not the case with the former Institution. The subscription is two guineas per annum, payable half-yearly, which entitles a member to the following advantages:—Lectures every Wednesday evening, on subjects connected with literature and science. The lectures of the first kind appear to be the more general. A Library, containing nearly 7000 volumes. The reading room is supplied with nearly all the newspapers and magazines. Classes also exist for the study of the French, German, Latin, and Greek languages, elocution, natural philosophy, and music. A concert is given once a fortnight by the latter class, when each member of the Institution is allowed to introduce a friend. The same rule, we believe, exists with respect to the elocution class, at which the discussions are carried on with much spirit. The Institution is very flourishing, and from the manner in which it is conducted it deserves success.

*Engine for Copying Busts.*—Many years since, the late Mr. Watt amused himself with constructing an engine to produce copies of busts or statues, either of the same size as the original, or in a diminished proportion. The substances on which he operated were various, and some of the results were shown to his friends, but the mechanism by which they were made has never been described. More recently, Mr. Hawkins, who had also contrived several years ago a similar machine, has placed it in the hands of an artist, who has made copies in ivory of a variety of busts. The art of multiplying in different sizes the figures of the sculptor, aided by that of rendering their acquisition cheap, through the art of casting, promises to give additional value to his productions.—*Babbage.*

# THE CHEMIST.

## APPARATUS.

Persons, when commencing the study of Chemistry, generally throw away a great deal of money in the purchase of apparatus for which they have no occasion, or which might as well be supplied by some of a less expensive dercription, and probably better suited to the wants of the student. As we do not suppose any of our readers wish to spend more money than is absolutely necessary, we advise them only to purchase apparatus and chemicals as they require them, and not to purchase a quantity under the idea that at some time or other they will become useful. One of our best chemists has said, that a chemical laboratory, though extremely useful, and even essential to all who embark extensively in the practice of chemistry, either as an art, or a branch of liberal knowledge, is by no means required for the performance of those simple experiments which furnish the evidence of the fundamental truths of the science. It is even advisable that the construction of a regular laboratory should be deferred till the student has made some progress; for he will then be better qualified to accommodate its plan to his own peculiar views and convenience. If this advice is applicable to those who can afford the requisite funds to fit up a laboratory, it applies with greater force to those who wish to proceed in the most economical manner they can, and whose laboratory, when completed, must be contained in a chest or closet. The most economical apparatus we ever remember to have seen employed for the purpose of chemical exper.ment, was used by Dr. B. Reid, at a lecture we had the pleasure of hearing him deliver some time since, when he explained the system adopted by him in teaching large classes of students at Edinburgh. For the purpose of examining substances in solution, evaporating, crystallizing, filtering, and testing an immense variety of substances, Dr. Reid employed only some small slips of window glass. It is desirable that a student should accustom himself to experiment upon small quantities of matter, and by using the simple apparatus just mentioned he is enabled to do so with the greatest facility. A few drops of any liquid placed upon a piece of window-glass, can be tested with as much accuracy, and the experiment may be conducted as successfully, as if twenty times the quantity had been operated upon, and the student will have the advantage of becoming more expert than if he used the greater quantity. For the purpose of experimenting on the gases, a Florence flask and a bent glass tube, with a cork to fit tightly into the mouth of the flask, will be found much more economical to use than a retort; a little practice will enable a person to operate with the one as easily as with the other; and if a dozen of the flasks are broken they may be replaced for eighteen pence or two shillings, at any oil shop; while two or three retorts will cost as much as the whole of them; and when commencing the study of Chemistry the student must expect to break more than two or three retorts. We would therefore recommend him not to be so anxious to be able to perform a variety of experiments as to understand thoroughly the rationale of a few. If he acts on this advice, a shilling or two will be quite sufficient to supply his laboratory, at the commencement, with any thing that is neceesary; and as he becomes better acquainted with the science he will be more able to select his apparatus.

*How to brew Beer.*—The art of brewing is very easy to be understood, for it is exactly similar to the process of making tea. Put a handful of malt into a teapot, then fill it with water, the first time rather under boiling heat. After it has stood some time, pour off the liquor, just as you would tea, and fill up the pot again with boiling water; in a similar manner pour that off, and so go on filling up and pouring off till the malt in the pot is tasteless, which will be the case when all the virtue is extracted. The liquor, or malt tea, thus extracted, must then be boiled with a few hops in it, and when it becomes cool enough, that is about blood-heat, add a little yeast to ferment it, and the thing is done. This is the whole art and process of brewing, and to brew a large quantity requires just the same mode of proceedure as it would to make a tea breakfast for a regiment of soldiers. A peck of malt and four ounces of hops will produce ten quarts of ale, better than any that can be purchased in London, and for which purpose a tea kettle and two pan mugs are sufficient apparatus. A bushel of malt to one pound of hops is the general proportion; and eighteen gallons of good light ale, or table ale, may be produced from one bushel of malt, and one pound of hops, which *will not cost above seven shillings*, that is, sixpence a gallon, or three halfpence a quart. Brewing utensils, consisting of a marshing tub and oar, a sieve, two coolers, and wicker hose, a spiggot, and faucet, together with a couple of nine-gallon barrels, new from the cooper's, cost but thirty-six shillings.

# INSTITUTIONS.

LECTURES DURING THE WEEK.

*London Mechanics' Institution*, Southampton-buildings, Chancery-lane.—Wednesday, July 26, adjourned Quarterly Meeting.—Friday, 28, Professor Calvert, on Elocution and the art of Reading, at half-past eight.

*Eastern Athenæum*, Stepney-green.—Wednesday, July 26, Dr. Mitchell, V. P. of the Institution, on Palestine, at eight o'clock.

*Gower Street Institution*, New-road.—Tuesday, July 25, Mr. Dalton, on Animal Physiology, at eight o'clock.

*Bermondsey Mutual Instruction Society*, British School-room, Great George-street.—Wednesday, July 26, T. B. Barret, Esq., on Digestion and Nutrition. at a quarter past eight o'clock.

*Tower-street Mutual Instruction Society.*—Monday, July 24, Mr. Lee, on the Administration of the New Poor Law, at eight o'clock.

*Finsbury Mutual Instruction Society.*—Tuesday, July 25, Mr. Johnson, on Oratory, at half-past eight o'clock.

## QUERIES.

*To the Editor of the Penny Mechanic.*

*Electrical Apparatus.*—Sir,—Perhaps your Correspondent F. V. E. will inform me, through the medium of your useful Publication, how to make the hole in the bottle mentioned in his ingenious article on Electrical Apparatus (in Number 37), without breaking it: and will you inform me what Number J. H.'s Leyden Phial (referred to by F. V. E.) appeared in.

Your well-wisher,
J. H. B.

[In Number 32.—Ed. Pm.]

*To melt Iron.*—Sir,—T. N. will fell much obliged by being informed, through the medium of your valuable work, in what manner he can melt a small quantity of iron—about half-a-pound.

*Staining Brass and Steel.*—Sir,—I shall feel obliged if I can be informed of what the liquid bronze is composed, by which brass workers produce a black colour upon polished brass work; and what composition will produce a jet black stain upon steel and iron.

Your Obedient Servant,
T. N.

*De Luc's Columns.*—Sir,—How are the philosophical toys constructed, which have, for some time past, been exhibited in the shops of the scientific instrument makers; and which, I believe, are generally known by the name of De Luc's Columns. I am aware the motion of the figures is owing to galvanic influence, which is continually kept up in the columns to which they are alternately attracted; but I am at a loss to know how these colums are constructed.

Sciolisterus.

ANSWERS TO QUERIES.

*Blue Lights.*—Sir,—I beg to inform D. J. that these Lights are fixed in conical hard cases of well-seasoned birch or alder, and above seven inches long.

In the broad end is an excavation, or cup, about two inches in diameter, by one in depth, for holding the composition.

The ingredients are in the following proportions: saltpetre seven parts, sulphur two parts, and three-fourths red orpiment. They are first pulverized, then rubbed between the hands, and afterwards passed through a hair sieve, since the brilliancy of the light depends upon the purity and thorough incorporation of the materials.

When the cup is filled and levelled, place a square of cartridge paper with two strands of quick-match across the centre, and tie the paper down round the head of the case. Complete by pasting a circle of brown paper over all.

I am, &c.,
Firebrand.

*Gilding Picture Frames.*—The frame must first be painted with a mixture of white paint and size eight or ten times over with a stiff brush. When it is thoroughly dry rub it over with pieces of course linen. The next thing to be done, is to colour it with yellow ochre, which must be well ground and sifted, and mixed up with size, the colour is to be laid on hot; and in works of sculpture supplies the place of gold, which sometimes cannot be carried into all the cavities of foliages and ornaments. Another layer is applied over this yellow, composed of armenian bole, blood stone, black lead, and a little fat: these being ground down together with hot size, three layers of this composition is applied upon the yellow, the one after the other has dried, being cautious not to put any into the cavities of the work to hide the yellow; the brush for this must be a soft one; and when very dry, it must be gone over again with a stronger brush. The next thing is gilding: you first take a pencil moistened, and wet part of it over with water; then with a squirrels tail fitted with a handle, take the leaf off and lay it gently on the wet part, then another part, and so on. Sometimes the leaf cracks in laying it on; these breaches must be made up with small bits of leaf taken up with a pencil, and the whole to be smoothed over with the same pencil, which must be a very fine one: any little defects afterwards may be mended with shell gold. The last operation is applying the vermeil (a composition of gum, guttæ, vermillion, and ruddy brown, ground and mixed up with venetian varnish and oil of turpentine) in all the little lines and cavities of the frame.

If the above is of any service to G. S. H. he is welcome, and the insertion will oblige Z.

## TO CORRESPONDENTS.

C. G. *We shall be happy to receive the papers. They will, we have no doubt, be acceptable to our readers.*

Z. F. P. *We cannot answer the query at length, any elementary work on electricity will give him all the information he requires.*

D. G.'s *suggestion shall not be forgotten.*

*An improvement by a* Mechanic *of the* Alarum, *described in Number 37, shall appear in an early Number.*

Several Queries and Answers *have been received, and shall be inserted as soon as possible.*

Mr. Payne, *and several other Correspondents, whose communications are accepted, shall have them published directly we can spare room for them.*

*We must again request our Correspondents to direct their letters* To the Editor of the Penny Mechanic, *and not to the Publisher.*

*Two or three letters have been returned to the Post Office this week, in consequence of the postage not having been paid.*

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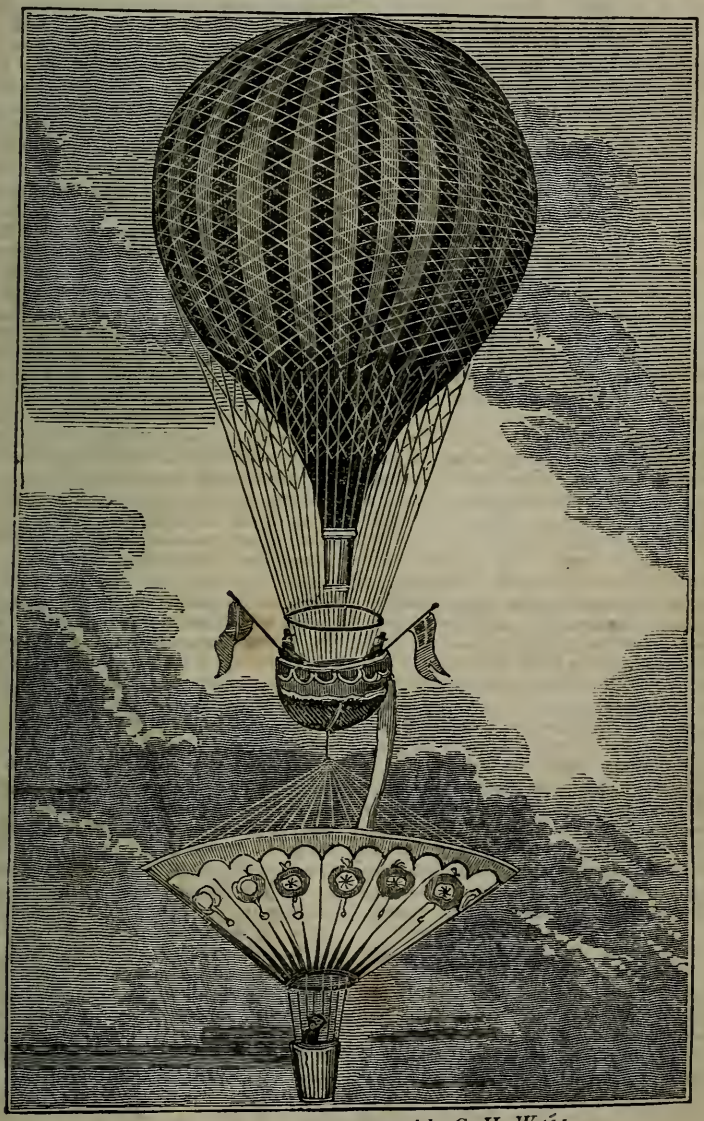
# THE PENNY MECHANIC,
## AND THE CHEMIST.

No. XL.] SATURDAY, JULY 29, 1837. Vol. I.

MR. COCKING'S PARACHUTE.



*Drawn on the spot, and Engraved by G. H. Wall.*

 Holloway Press: D. A. Doudney.

## FATAL RESULT OF THE PARACHUTE DESCENT.

We regret to have to state that the experiment of the descent of the parachute has terminated fatally to Mr. Cocking. In consequence of the announcement that he was to ascend in his parachute suspended to the great Nassau Balloon, a great number of persons, amongst whom were many of the first nobility of the country, assembled in the gardens to witness the experiment. Without the gardens, upon Vauxhall-bridge, and upon Millbank, the crowd was immense. It was in circumference 107 feet four inches. From the bottom of this machine, which was constructed of fine Irish linen, a basket of wicker was suspended, in which Mr. Cocking placed himself. The distance between the basket and the car in which were Mr. Green and Mr. Spencer, was between forty and fifty feet. The ascent of the balloon took place about twenty minutes before eight o'clock. When Mr. Cocking entered the basket of the parachute he was perfectly collected, and exhibited no appearance of want of nerve or indecision.

At twenty minutes to eight o'clock, every thing being in readiness and the parachute attached to the car of the balloon, the ascent took place. Nothing could be more majestic. The weight and great extent of the parachute apparently rendered the motion of the balloon more steady than on any former ascent, and the almost total absence of wind assisted in keeping the balloon in a perfectly perpendicular position. There was not the slightest oscillation; the balloon and parachute sailed through the air with a grandeur which exceeded anything of the kind ever before witnessed, and continued in sight for about ten minutes. A good deal of ballast was discharged almost immediately over the enclosure, after which the huge machine rose rapidly, but not so suddenly as to break the even current of its course. It was expected by those in the gardens that Mr. Cocking would have descended so near Vauxhall as to afford them a view of his descent. This was not the case. He was lost in the clouds, and the company were for some time left in conjecture, but certainly not in anticipation of the result of the experiment. A son of Mr. Gye was the first person who announced to our informant the fatal catastrophe. This gentleman followed on horseback, and arrived in a field, near Lee, in Kent, just in time to learn that the parachute had descended with such violence, that Mr. Cocking had lost his life in his experiment. The intelligence was not suffered to transpire for some time in hopes that the account might be incorrect, and that Mr. Cocking might have only been stunned, or have fainted, it being remembered that something of this sort occurred on the descent of M. Garnerin some years ago. It was, however, very shortly ascertained that the intelligence was too true. It appears that the descent of the parachute was made over a field close to Lee, that on approaching the ground the parachute, from some cause or other, most probably from the hoop which destended the external circumference being composed of a hollow tube of tin, collapsed, and consequently opposed no resistance whatever to the atmosphere, but turned over and over in the air, and came down with a frightful velocity. Mr. Cocking was not, as we are informed at present, thrown out of the basket, but he received a dreadful wound on the right temple, and had his ancle dislocated. He moved his hand once after his fall, but exhibited no other signs of life. Several country people, who were close by, procured a watled hurdle, placed him upon it, and conveyed him without delay to the Tiger's Head Inn at Lee. He was immediately attended by Dr. Chowne, who was on the spot; but all medical assistance was unavailable. The arteries of his arms were opened, but it was to no purpose, life had fled. It is but justice to say, that this fatal result is attributed in no manner to any person connected with Vauxhall or with the balloon. Mr. F. Gye endeavoured, but in vain, to persuade Mr. Cocking to have the hoop of the parachute of ash, but that unfortunate gentleman, from a notion that tin would be sufficiently strong and much lighter, refused to listen to his suggestion.

"The inflation," says Mr. Green, "commenced about 12, under the able direction of the engineer to the London Gas Company, and was completed by 5 o'clock. Prior to the parachute being attached to the balloon I caused a trial to be made with the view of ascertaining whether the buoyancy of the latter was sufficient to carry up the former with safety. The result of this trial was, after some arrangements with respect to the ballast, of which I was compelled to give out about 650lb. in weight, in every respect, satisfactory. The abandonment of this large quantity of ballast I found to be absolutely requisite in order with safety to commence the ascent. The balloon was then allowed gently to rise a sufficient height to be conveyed over the

parachute; but in consequence of the great and unavoidable delay which was necessarily caused in affixing the two machines, the gas in the former became very considerably condensed, from a reduction of its temperature. It, thereupon, became a matter of compulsion that I should get rid of 100lb. more of the ballast, which I emptied out of the bags through a tube, constructed of canvass, and about fifty feet in length. The object in having this tube was, that any ballast I might deem it advisable to throw out during our voyage should take such a course as would entirely clear the broadest expanse of the parachute. The connexion between the balloon and the parachute was at length completed by the rope of the latter being made fast to the liberating iron by which Mr. Cocking was to free himself from the balloon.

"It is but justice to myself I should here state, that I had on several occasions expressed my determination not to liberate the parachute from the balloon, upon the ground, setting aside any other considerations, that I might select a moment for the severance when Mr. Cocking was not altogether prepared or ready for his descent, and therefore if any accident were to accrue to him, that I of course should be regarded as the responsible party, and the one to whom blame would naturally attach.

"Mr. F. Gye, every thing being in readiness, about twenty-five minutes to eight o'clock, gave the signal for the whole of the apparatus to be released from its trammels, and we instantly rose very steadily, taking an easterly course.

"Mr. Cocking had always desired that we should ascend to an elevation of 8,000 feet, about one mile and a-quarter, at which height he proposed to detach himself from the balloon, and to commence his descent. Finding, therefore, that our upward progress was very slow, I requested Mr. Spencer to discharge some more ballast, and he accordingly threw the contents of a bag weighing twenty pounds through the tube already named. This proving of little avail, I directed a second and then a third bagfull to be got rid of by the same means.

"As soon as we had attained the height of 5,000 feet I told him that it would be impossible for us to get up as high as he desired in sufficient time for him to descend by the light of day. Upon this Mr. Cocking said, 'Then I shall very soon leave you; but tell me whereabouts I am?' Mr. Spencer, who had a few minutes before caught a glimpse of the earth, answered, 'We appear to be on a level with Greenwich.' I then asked him if he felt himself quite comfortable, and whether he found that the practical trial bore out the calculations he had made? Mr. Cocking replied 'Yes; I never felt more comfortable or more delighted in my life.' Shortly afterwards Mr. Cocking said, 'Well, now I think I shall leave you.' I answered, I wish you a very good night and a safe descent, if you are determined to make it, and not to use the tackle (an apparatus constructed under the direction of Mr. F. Gye, to afford us the facility of assisting Mr. Cocking to haul himself up into the car of the balloon if necessary.) Mr. Cocking, to this question, made no other reply than 'Good night, Spencer; good night, Green.' At this instant I desired Mr. Spencer to take fast hold of the ropes, and like myself to crouch down in the car. Scarcely were these words uttered before we felt a slight jerk upon the liberating iron, but quickly discovered, from not having changed our elevation, that Mr. Cocking had failed in his attempt to free himself. Another but more powerful jerk ensued, and in an instant the balloon shot upwards with the velocity of a skyrocket.

"The effect upon us at this moment is almost beyond description. The immense machine which suspended us 'between heaven and earth,' whilst it appeared to be forced upwards with terrific violence and rapidity through unknown and untravelled regions, amidst the howlings of a fearful hurricane, rolled about as though revelling in a freedom for which it had long struggled, but of which, until that moment, it had been kept in absolute ignorance. It at length, as if somewhat fatigued by its exertions, gradually assumed the motions of a snake working its way with astonishing speed towards a given object. During this frightful operation, the gas was rushing in torrents from the upper and lower valves, but more particularly from the latter, as the density of the atmosphere through which we were forcing our progress pressed so heavily on the valve at the top of the balloon as to admit of comparatively but a small escape by that aperture.

"At this juncture, had it not been for the application to our mouths of two pipes leading into an air-bag with which we had furnished ourselves previous to starting, we must, within a minute, have been suffocated; and so, but by different means, have shared the melancholy fate of our friend. The gas, notwithstanding all our precautions, from the violence of its ope-

BIRKBECK COLLEGE

rations on the human frame, almost immediately deprived us of sight, and we were both, as far as our visionary powers were concerned, in a state of total darkness. for between four and five minutes.

"As soon as we had partially regained the use of our eyes, and had somewhat recovered from the effects of the awful scene into which, from the circumstances we had been plunged, our first attention was directed to the barometer. I soon discovered that my powers had not sufficiently returned to enable me to see the mercury, but Mr. Spencer found that it stood at 30·20, giving an elevation of 23,384 feet, or about four miles and a quarter. I do not conceive, from the length of time I had boen liberating the gas, that this was any thing like our greatest altitude, for we were evidently effecting a rapid descent.

"Recollecting the late hour at which we quitted Vauxhall, I now began to be anxious about the time, and on applying to Mr. Spencer, ascertained that it wanted not more than a quarter to nine o'clock. From this I was aware, notwithstanding in our then position we were blessed with a magnificent light, that on emerging from below the clouds darkness would have assumed her sable hue over the earth, and that we should have much difficulty, therefore, in ascertaining the nature and character of the country, supposing us to be over the land, on which we must effect our final descent. I consequently became extremely anxious to make our way through the clouds as quickly as possible, which having done, we proceeded until we had reached within some 300 feet of the ground, when we found it requisite, from our inability to ascertain the nature of the ground, the whole country beneath us offering the appearance of thick woods, to cast out every article of ballast and moveable matters, even to ropes and empty ballast-bags, in order to prevent us from coming in contract with what was supposed to be trees. After calling out for some time, and hanging out the grapnel, we heard voices in reply, and the parties speedily drew us to a safe place of landing, which proved to be close to the village of Offham, near Town Malling, seven miles west of Maidstone, and twenty-eight from London.

"At half-past ten o'clock this morning we quitted Town Malling, and it was not until our arrival at Wrotham, at which place I inquired whether they had heard where Mr. Cocking had descended, that I became acquainted with the unexpected and melancholy result of his experiment." —*Times.*

## SAINT MONDAY.

### DULWICH GALLERY OF PAINTINGS.

At this season of the year, we advise all our readers living in and near London, who can spare an afternoon from their employments, to visit the Dulwich Gallery of Paintings. It is a beautiful collection, and the public are admitted without having to pay anything either for admission, or to the attendants at the gallery. The paintings were bequeathed to Dulwich College by Sir Francis Bourgeoise in 1811, on condition we believe, that the public should be admitted to view them *gratuitously;* and the directions of the testator have been acted upon in a liberal spirit, which it would be well for the public if the trustees of other bequests for the benefit of the nation would imitate.

Dulwich Gallery is situated about five miles from London Bridge. From April to November, it is open from ten o'clock in the morning, till five in the evening. During the Winter season, from November to April, it is open from eleven till three. It is closed on Fridays and Saturdays throughout the year. In order to be admitted it is requisite to procure a card, which must be presented to the keeper of the gallery. Messrs. Moon, Boys and Graves, of 6, Pall Mall; Mr. Moon, Finch Lane, Cornhill; Mr. Markby, Croydon; and Mr. Dunkin, of Bromley, will all give tickets of admission on being applied to for them; and it is requisite that those who wish to view the paintings should provide themselves with tickets before leaving town, as they will experience great difficulty in obtaining any at Dulwich. The door-keeper will not admit visitors without presenting a ticket; but one is sufficient to introduce a party. On entering the visitors have to write their names and addresses in a book kept for the purpose; and they are then at once allowed to enter the gallery. It consists of one long room, divided into compartments, and contains between three and four hundred paintings, which are nearly all in very good condition. Some few want cleaning; and some—one in particular—we think it would be advisable to remove altogether, although to the artist and connoisseur such paintings as that to which we allude may not appear to overstep the modesty of nature, we are inclined to believe that the majority of the visitors at the gallery think otherwise. We are no advocates for the modesty that would clothe the Apollo Belvidere in breeches, but a painting that might not be improper in a private collection, is sometimes unfitted for a public exhibition, and

we think this to be the case with the one alluded to. We suppose however that the trustees, or governors of Dulwich College, to which the gallery is attached, have good reasons for continuing the painting in the collection, and also for removing the veil, which we believe was once placed before it. Among the paintings the visitor will find the celebrated portrait of Mrs. Siddons as the Magic Muse, by Sir Joshua Reynolds; the Descent from the Cross, by Vandyke; the Martyrdom of Saint Sebastian, by Guido; and the Group of Cupids, by Rubens. Besides these the gallery contains some very excellent specimens of the Italian and Flemish schools; and the works of our English masters will be found equally worthy of attention. Artists wishing to copy any of the paintings, can obtain leave to do so on making application by letter to the Master of Dulwich College, and forwarding their name and address.

The excellent state of preservation of the pictures, and the entire absence of any of those scratching and scrawlings by which many persons like to make it known that they have visited and disfigured any work of art, &c., affords, we think, sufficient proof of the injustice of the charge, that the exhibition of such works cannot be thrown open to the public without leading to their mutilation and disfigurement. It is true that the public being admitted to this gallery by tickets, there is some slight check upon those who might otherwise be inclined to misconduct themselves; and the attendants also protect the paintings; but when it is borne in mind that many places to which admission can only be obtained either by a douceur to the attendants, or by paying a certain fee, have not escaped the "English propensity," we think there is very good reason to conclude, that where the visitors of an exhibition, being admitted free, feel that any injury to the works exhibited, is an injury to themselves, there is far less likelihood of their permitting it to be effected, than where they feel they are only viewing some persons' property, about the preservation of which they may feel but little interest or concern.

## WORKING MEN'S ASSOCIATIONS.

We stated last week that in our present Number we should call the attention of our readers to a plan, which if acted upon with spirit, would do much towards effecting that social amelioration in the constitution of the industrious classes which must eventually take place, and which every good man will endeavour to promote as far as possible. The working classes of Great Britain, and of the metropolis and manufacturing towns in particular, occupy a station in society, and possess a political influence unknown to the operatives of other countries of Europe. We do not except even those of France. Within the last few years they have made a rapid, and to some, it may appear an extraordinary advance. They are no longer mere hewers of wood and drawers of water, and though the greater majority of them, it is true, do not possess the elective franchise, they influence those who exercise it to a considerable extent. Indeed, we think the power of no class of society has increased so rapidly, and is increasing so rapidly, as that of the working classes. This change is to be attributed entirely to their intellectual improvement. And this we think has been produced principally by the establishment of Mechanics' Institutions and the cheap diffusion of knowledge of every kind by the press. In no country in the world—not even in America—does a working man possess such facilities for improving his mind as in this country. Compare the condition of a mechanic in Spain, in Russia, or in Turkey, with that of a working man in England. See the vexatious tyranny and impertinent interference to which the first is subjected, and then turn to our own countryman and mark the difference. There are many who are fond of doing this, but only in order to draw from the comparison conclusions as erroneous and absurd as any that can be imagined. It is surely no reason because men in one country submit to be treated but little better than beasts, that those of another should be content to labour under social disqualifications, for which no other reason can be assigned, but that they are submitted to by men in other countries. Such, however, is too frequently the conclusion that many persons arrive at from comparing the state of foreign workmen with our own, but we have alluded to the circumstance for a very different purpose. What is it keeps the operatives of the countries mentioned in the condition they are in? It is the want of co-operation; and the consequent want of that knowledge that can only be obtained by co-operation. A striking feature in the history of the working classes during the last few years has been the manner in which they have shown the advantages of combining together for the accomplishment of any particular object. Their

great political unions astonished the other classes of society; and their uniting for the purpose of obtaining scientific knowledge and literary recreation at mechanics' institutions is a new feature of the age. There are certain difficulties attending the formation of these excellent institutions, however, which render it difficult, if not impracticable, to establish one successfully except in towns containing a large population; and even in such a place as London, where so many are prospering, and where probably all the advantages that can be obtained from them are derived by the members. Yet even there it is felt that something more requires to be done in order to derive from them all the advantages they are capable of producing. In the majority of these institutions there is a sad want of social feeling amongst the members. They attend at the library for the books they require; they visit they reading rooms to see the newspapers; and they meet in the theatre to hear the lecture; but unless some few of the members are possessed of more spirit than the others, and "get up" a ball or an excursion occasionally, but very few acquaintances are formed between the members, and one great advantage that might be derived from such institutions is lost. Many of the members of the London Mechanics' Institution some two or three years ago felt this inconvenienco so much, that they formed themselves into what they termed a Mutual Instruction Society. The members were in the habit of meeting once a week in a private room at a coffee-house, and discussed questions relating to moral philosophy, metaphysics, and occasionally lectures were delivered on different branches of science by members. This society for a considerably time proceeded very successfully, and numerous societies of a similar nature were formed by its members, and those who approved of the plan. These societies have since spread rapidly over London, and many have been formed in provincial towns. The members have generally been young men, but within the last twelvemonth, a new application of the principle has been exhibited by the establishment of what are called "Working Men's Associations." We intended to have given a description of their objects and advantages in the present Number, but finding we have not room to do so, we must resume the subject next week.

## CHEAP ELECTRIC APPARATUS.

*To the Editor of the Penny Mechanic.*

SIR,—Observing in Number 37 of your useful periodical, a description of a cheap electrical apparatus, which to me appears not quite so clear as I think it should be, to be understood by that portion of your readers to whom, I apprehend, from the tenor of the communication it is particularly addressed, namely, the juvenile portion, and of which I am happy to say, I know there are many who purchase it, I take the liberty of sending you a few observations thereon, which I think will be acceptable to many who have read that article; and will not be regarded with any ill feeling by your correspondent T. V. E.

Your correspondent begins his description by saying "make a hole through the bottom, and opposite the mouth of a common wine bottle;" now I venture to assert that had T. V. E. ever made "a hole through the bottom of a common wine bottle," he would find that it is "no joke" to drill a hole through a piece of glass of that thickness, and therefore would not in giving a desciption of a Cheap Electrical Apparatus recommend others to do so. Having made about two years ago an electrical machine from a common wine bottle, I can inform your readers of a much easier mode of making an axle to their bottle: there is no occasion to make a hole through the bottom, they have only to form from a small block of wood a counter part to the indentation at the bottom of the bottle, from which their axle can project so as to fit in loosly; but I will not leave your readers as T. V. E. does, by saying, "and fix it firmly in the bottle," they must know "how" to fix it firmly in the bottle. It is as follows: make a cement as described in the last column of Number 9 of this Magazine, after having melted a sufficient quantity, pour it into the bottom of the bottle, and then imbed in it the little block of wood in which your axle is fixed. This cement will be found well worth the trouble of making, being particularly useful in fixing the conductor on the glass rod, and in fixing the glass pillars, many of which are required in constructing electrical apparatus.—I now beg to make an addenda to your correspondent's description of the conductor: let a row of pins with the points outwards be driven into the small cylinder so as to come within a quarter of an inch of the bottle, these will draw off the electricity, and you will be able to accumulate in the conductor a much greater quantity than you could without them. By inserting the above you will oblige Your obedient humble servant,

SCOLISTERUS.

# THE CHEMIST.

## PREPARATION OF IODINE.

BY M. BUSSY.

The process of extracting iodina generally followed, and which consist in decomposing the mother-waters of kelp by means of concentrated sulphuric acid, is well known to be liable to variable results, on account of a portion of the iodine coming over in the state of hydriodic acid and chloride of iodine, so that in either case there is always a considerable loss. To avoide this inconvenience, M. Soubeiran proposed to precipitate the iodine from the mother-waters by means of sulphate of copper, and afterwards to decompose the iodide of copper by peroxide of manganese at a high temperature. But this process requires minute attention and much precaution to separate the whole of the iodine existing in the mother-waters, and we do not believe that it has been employed in any manufactory. These circumstances induce me to publish a far more simple method, which has been lately employed by some manufacturers of iodine; it was discovered (if we are rightly informed) by M. Baruel, director of the chemical works at the Faculty of Medicine; it consists in precipitating the iodine of the mother-waters of kelp by a current of cholorine. In this process the mother-waters are first to be evaporated to dryness, and to the residue there is to be added a tenth of its weight of powdered peroxide of manganese; the two substances are to be perfectly mixed, and subjected to a dull red heat in an iron vessel, frequently stirring them; the object of this calcination is to convert the sulphurets and hyposulphates, of which the mother-waters contain a large quantity, into sulphates. It is extremely easy to determine when these compounds are converted into sulphates by taking a small quantity of the calcined matter and pouring upon it an excess of sulphuric acid. It ought not to yield, when the conversion is perfect, either sulphuretted hydrogen or a deposit of sulphur. If violet vapours are disengaged during the calcination, the heat must be lowered to avoid loss. When the sulphurets are decomposed, the residue is to be dissolved in a sufficient quantity of water to give a solution of sp. gr. 1·333; through this solution there is then to be passed a current of chlorine gas, taking care to stir it constantly with a glass rod: the liquor becomes of a deep brown colour, afterwards turbid, and deposits iodine in the form of a black powder; it is to be collected and distilled in a glass retort, in order to procure it in crystals. The only difficulty in this process is to determine the point at which the action of the chlorine should cease, that no excess may be used which would react upon the iodine precipitated. This excess of chlorine is especially to be apprehended, when it is also intended to separate from the same mother-waters the bromine which they contain.

In order to avoid adding excess of chlorine, the liquor which is supposed to be nearer saturation, may be suffered to be settled for a short time, and the current of chlorine being inturrupted it is to be directed on the surface of the liquid. If it contain any iodide in solution, a pellicle of iodide will be observed to form on the surface; this effect is not produced when all the iodine is precipitated; in the latter case the liquor becomes quickly clear and retains only a reddish tint.—*Philosophical Magazine.*

*Constitution of Starch.*—M. Payen, in a memoir, quoted in the *Journal de Pharmicie* states that starch in whatever manner or from whatever part of vegetables it may be obtained, whatever may be its form, its age, or its state of aggregation, has always the same chemical constitution: its conversion into dextrine by diastase sulphuric acid, potash, &c., are modifications of its physical properties, without in the least degree altering its chemical constitution, which is represented by $C^2 H^5 O^5$

*To remove Fruit and Wine Stains.*—Put about a table spoonfull of muriatic acid into a teacup and add about a teaspoonfull of powdered manganese, then set the cup in a larger one filled with hot water, moisten the stain with water, and expose it to the fumes that arise from the teacup. If the exposure be continued a sufficient length of time the stains will disappear. This solution can only be applied with safety to white goods, as it discharges all printed and dyed colours.

J. R. W.

*To make a beautiful Green Paint.*—Add to a hot solution of sulphate of copper, (blue vitriol) a little solution of carbonate of soda; a beautiful powder (known by the name of French green) will be precipitated. The powder is a sub-carbonate of copper. J. R. W.

*To make Cosmetic, Pearl Powder.*—Dissolve besmuth in nitro-mutriatic acid, and gradually add to the solution cold distilled water; upon which a beautiful white powder, which is an oxide of bismuth, will be precipitated.

## MISCELLANIES.

*The School of Design* for the Improvement of *Working Men* will be opened on Tuesday next the 1st of August. The hours of attendance will be from Six till Nine o'clock every evening, except Saturdays. Each student will have to pay *Two Shillings* per week, and provide himself with materials for drawing.—Application for admission to be made at Somerset House.

*Prizes of the Institute of Civil Engineers.*—The following subjects have been proposed by the council as those on which they are anxious to receive communications, and for the best papers on which they will award premiums. No distinction will be made between the communications of members or associates, and others in no way connected with the institution, and more than one premium will be awarded if the papers sent in are of sufficient merit. The prizes will not be confined solely to the following list.—1. The Nature and Properties of Steam, considered with reference to its application as a moving power for machinery.—2. Warming and Ventilating Public Buildings and Apartments; with an account of the methods which have been employed most successfully for ensuring a healthy state of the atmosphere.—3. An account and Drawings of the Original Construction and Present State of the Plymouth Breakwater.—4. The Ratio from actual experiment, of the Velocity, Load and Power of Locomotive Engines on Railways; first upon levels, second upon inclined planes.—5. Drawings, Description, and Account of the principles of Huddart's Rope Manufactory, at Limehouse.—6. The Sewerage of Westminster.—7. Drawing and description of the Shield at the Thames Tunnel, with an accurate account of the method by which it is advanced and worked.

## INSTITUTIONS.

### LECTURES DURING THE WEEK.

*London Mechanics' Institution*, Southampton-buildings, Chancery-lane.—Wednesday, Aug. 2, J. Webster, esq., on Geology.—Friday, 4, Professor Calvert, on Elocution and the art of Reading, at half-past eight.

*Aldersgate Street Institution.*—Wednesday, Aug. 2, J. S. Buckingham, esq., on Palestine, at eight o'clock.

*Eastern Athenæum*, Stepney-green.—Wednesday, Aug. 2, Half Yearly General Meeting, at eight o'clock.

*Saint Pancras Institution*, Colosseum House, New Road.—Tuesday, Aug. 1, General Quarterly Meeting, at half-past eight o'clock.

*Bermondsey Mutual Instruction Society*, British School-room, Great George-street.—Monday, July 31, Mr. Errington, on English Literature, at a quarter past eight o'clock.

*Tower-street Mutual Instruction Society.*—Monday, July 31, Mr. Robinson, on Chemistry, Oxygen and Nitrogen, at half-past eight o'clock.

*Finsbury Mutual Instruction Society.*—Tuesday, Aug. 1, Mr. Saull, on the Influence of Scientific Knowledge in forming the Character of the Future Generations of Mankind, at half-past eight o'clock.

## QUERIES.

*To the Editor of the Penny Mechanic.*

*Hair Dye.*—Sir,—Can any of your numerous readers inform me what will dye *White or Grey* Hairs *Black*, (except the nitrate of silver) without acting as a depilatory; if they can they will confer a favour upon,

Cani Capilli.

### ANSWERS TO QUERIES.

*Alarums.*—If D. N. in Number 30, will forward his address to the Printer of this Magazine, he may hear of a plan for an alarum that will no doubt answer his purpose, being of easy construction, and having the power of waking without noise, or disturbing others.

N. D.

## TO CORRESPONDENTS.

*It was our intention to have published the* Penny Mechanic *in* yearly *volumes; but having of late had many inquiries for complete sets of our work, and numerous objections to keeping a whole twelvemonth's* loose numbers, *we are disposed to meet our friends half way, and have therefore come to the determination of completing a volume at the end of* every Nine Months. *The present, then, will be the last Number of the first volume, and in a week or two we will publish a Supplementary Number, containing its Title-page, Index, and Frontispiece. The volume will be neatly bound in cloth, price* 4s 6d., *and, we need not remind our Readers, will be by far the Cheapest Mechanical Work Published!*

C. H. S, on Aerostation, *shall have the paper inserted.*

Rugbœensis. *The Mechanism appears to be simple and ingenious, and we will endeavour to find room for a description of it.*

Mr. E. Ellen's *Translation of M. Latour's Paper on* Vinious Fermentative *shall be published.*

J. G. *on Removing the Stain of* Indelible Marking Ink, *next week.*

A City Prentice. *We have received a similar communication from another correspondent which is already composed. He is thanked for the letter.*

Mr. Wallington. *The notice was intended for him. We are much obliged for the drawing.*

A. M. *We have forwarded the card as he wished to* an Operative Mechanic.

*We are inclined to agree with* A Plain Man, *that the communications of some of our correspondents would receive more attention if they did not use such "curious signatures."*

Received.—W. S—A Constant Reader.—*and* F. C. P.

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